November, 1947 Vol. 36, No. 9

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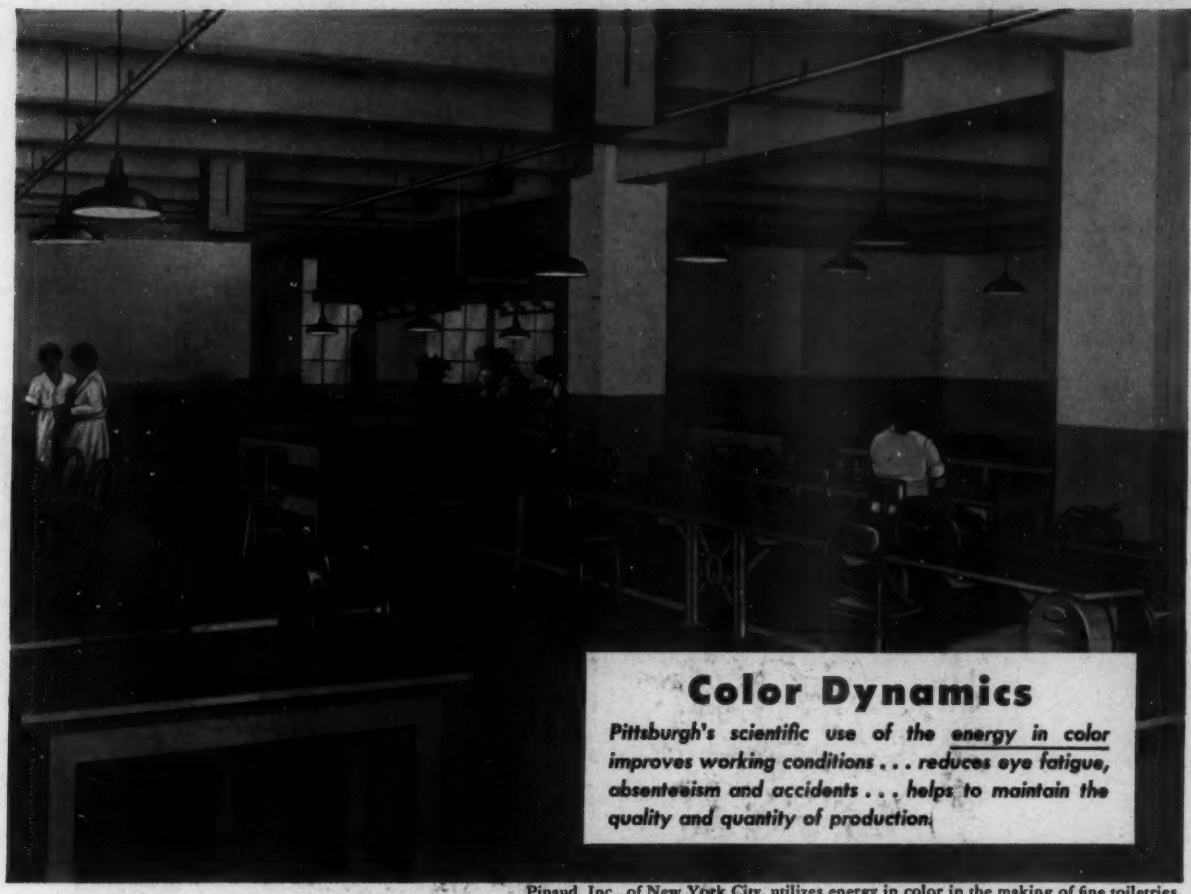
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

The Shop Teachers' Professional Magazine


Color Dynamics
Pittsburgh's scientific use of the energy in color improves working conditions . . . reduces eye fatigue, absenteeism and accidents . . . helps to maintain the quality and quantity of production.

Pinaud, Inc., of New York City, utilizes energy in color in the making of fine toiletries.

Modern Vocational Schools teach future shopmen how this new painting system improves plant efficiency!

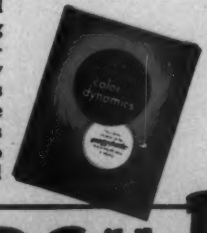
TRAINING of skilled shopmen is no longer confined merely to courses in metal, machinery and methods. It includes study of the influence of physical and psychological factors upon workmen and their output.

That's why vocational and manual science teachers now include Pittsburgh's COLOR DYNAMICS in their courses. They recognize that greater knowledge and more widespread use of this method of painting are making a great contribution to the improvement of production and welfare of workers.

Color Dynamics is based upon human reactions to the *energy in color.* Science has established the fact that color has a marked influence upon physical, mental and nervous systems.

Shopmen in many plants are finding that color properly "engineered" on machines, walls, floors and ceilings of their plants actually produces *more work per man-hour and more man-hours per man!* Wherever COLOR DYNAMICS has been applied in industry both management and employees are unanimous in praise of the results.

COLOR DYNAMICS requires that every color used on walls, floors, ceilings, machines and mobile equipment perform definite duties. By the use of focal and eye-rest colors, operating parts of machines are separated from stationary parts and the materials being fabricated. The worker is able to see his job better. Eye fatigue, so often the cause of lowered efficiency, is lessened. Morale-building colors improve the worker's mental attitude toward his job. Safety colors warn him of danger areas and reduce accident hazards.



If you want your students to be equipped thoroughly for their future tasks, begin now to teach COLOR DYNAMICS in your school. Better still—demonstrate its principles in a practical manner. Apply them in the decoration of your classrooms and equipment—and see the difference.

Write today for a free copy of our interesting booklet, "COLOR DYNAMICS". Packed with useful information and practical suggestions, it makes a fine textbook. Pittsburgh Plate Glass Company, Paint Div., Dept. IV-117, Pittsburgh 22, Pa.

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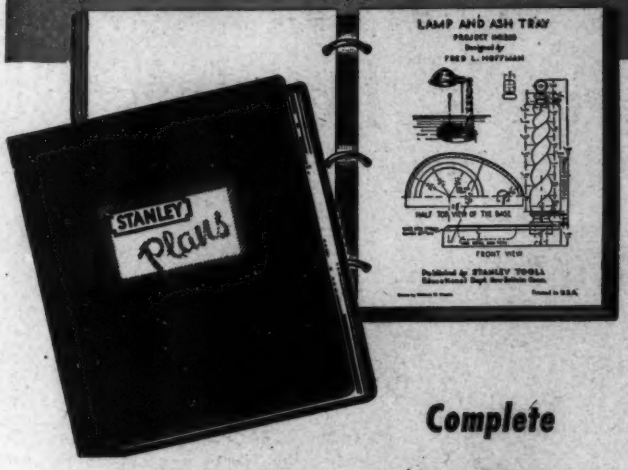

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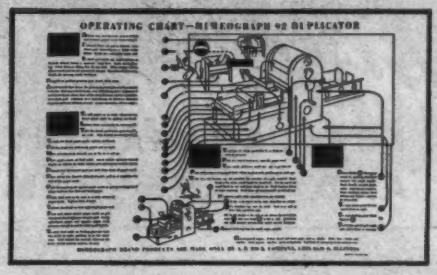

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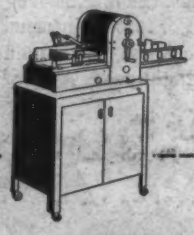

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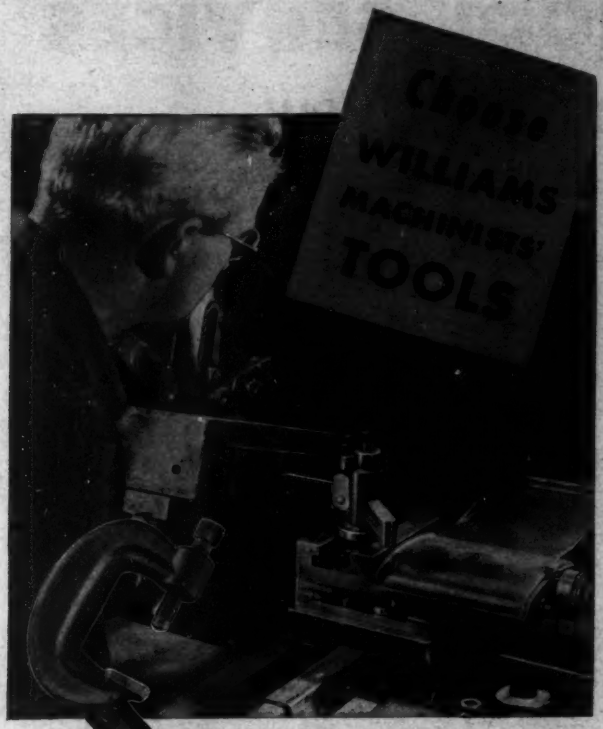

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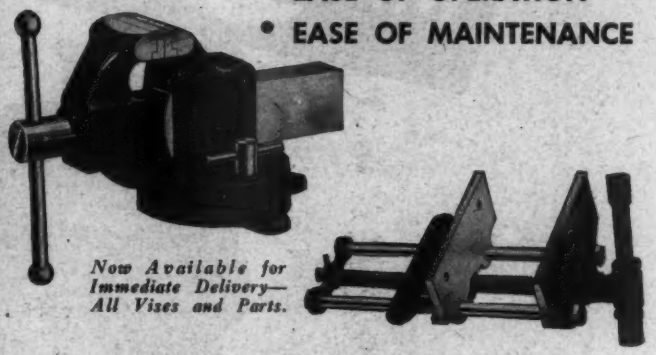

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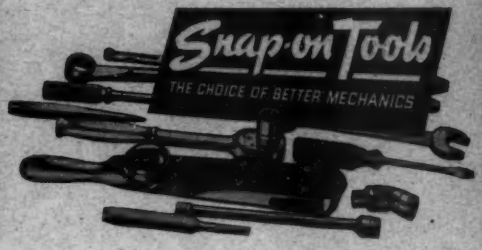

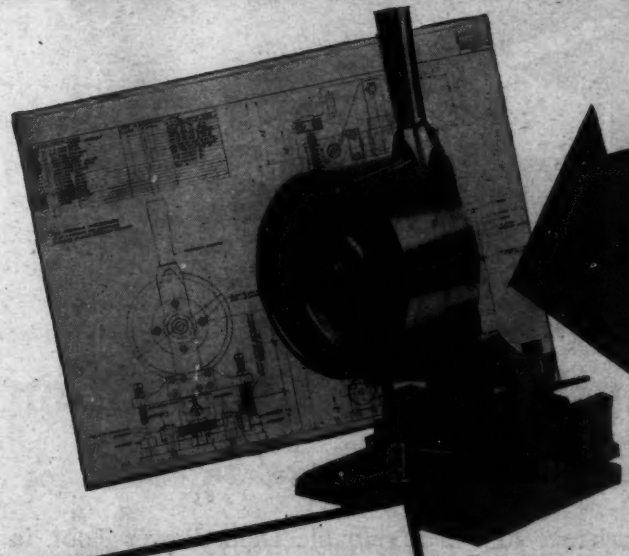

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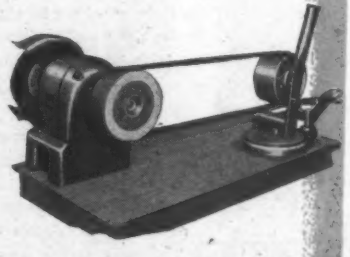

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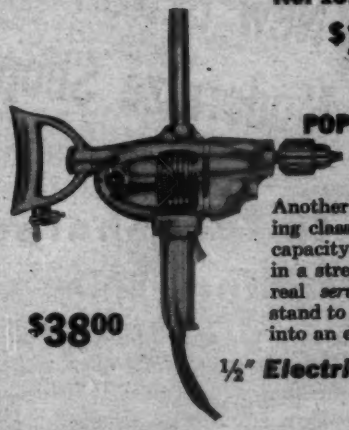

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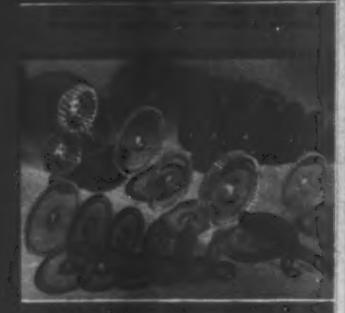

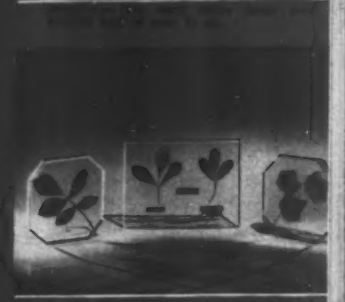

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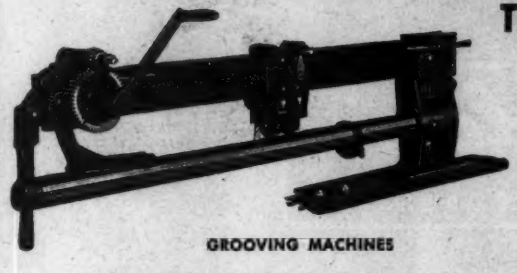

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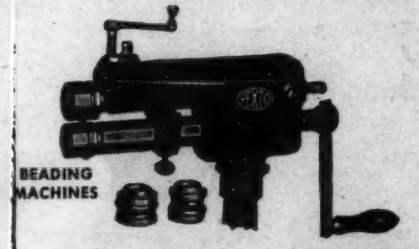

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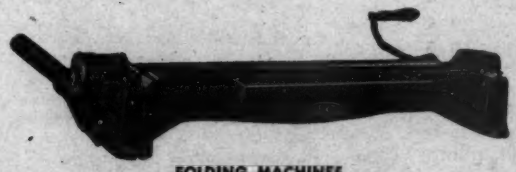

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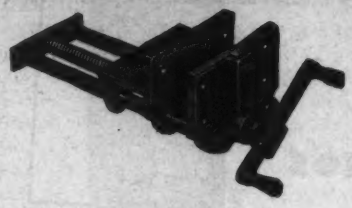

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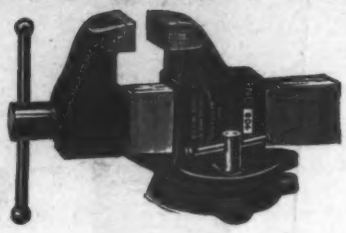

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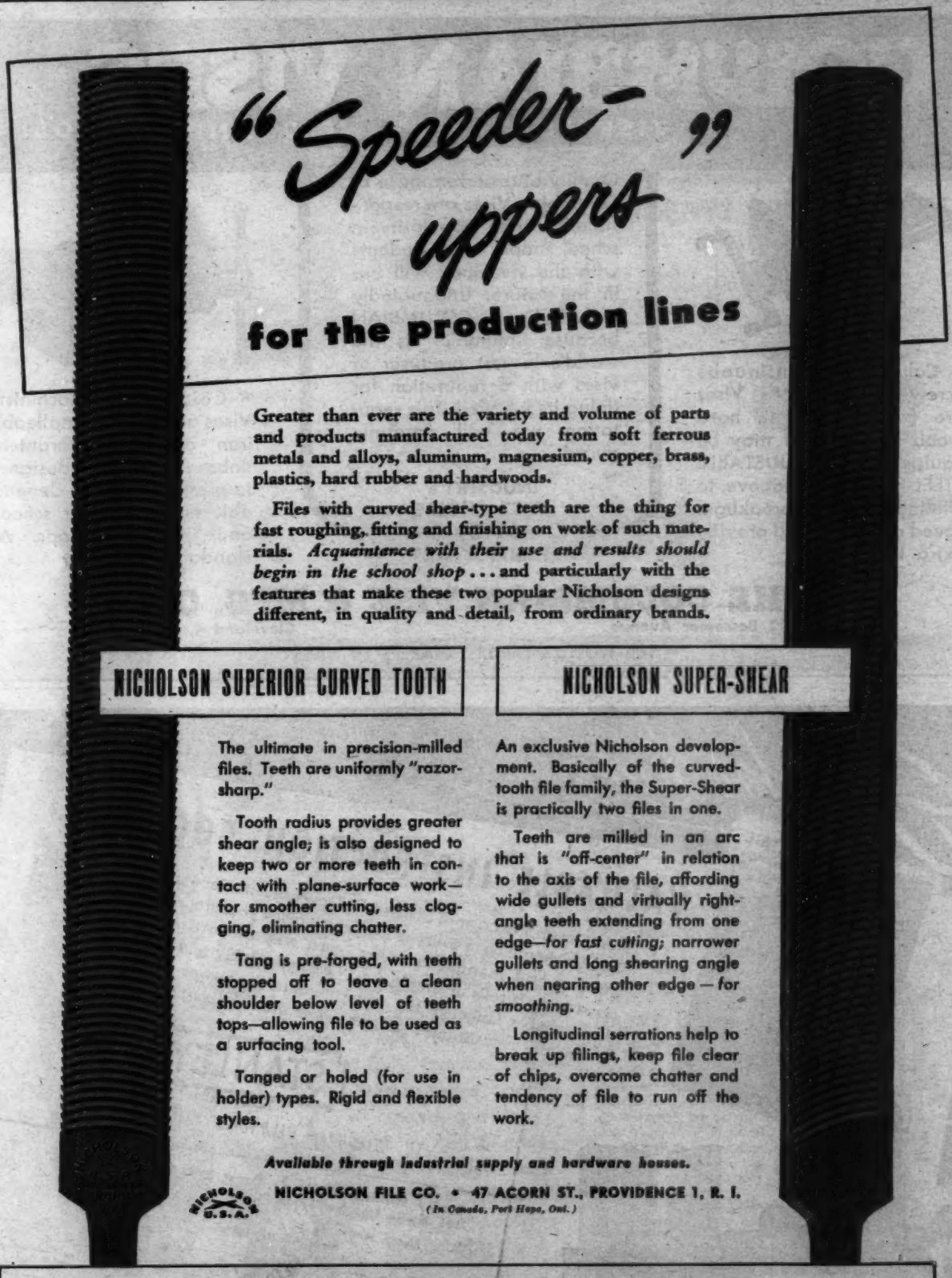

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▶ Why Attend Conventions

The months of October, November, and December are crowded with convention programs. There are local, regional, state, and national gatherings; and administrators, directors, supervisors, and teachers are hard pressed to decide which to attend and which to strike off the list for this year.

Unfortunately, too many teachers do not have an opportunity to attend some of these conventions which could assist them in their work so much. Others must be willing to lose salary for the time spent at the convention and pay their expenses besides. It is time that school boards realize that the growth of a teacher in his profession demands that he attend these professional gatherings, and that the meager salaries paid him do not permit him to make use of this method of improving himself.

Until the time comes when teachers have these expenses paid for them, earnest professional minded instructors will still find ways and means to attend important conventions.

We hope everyone of our readers will be able to attend his own state meetings and that a goodly number will have an opportunity to go to the A.V.A. convention at Los Angeles.

▶ Coming Conventions

Oct. 27–29. School Broadcast Conference at Chicago, Ill. Headquarters, Hotel Continental. Director, George Jennings, 228 N. LaSalle St., Chicago 1, Ill.

Nov. 3–5. American Occupational Therapy Association at Coronado, Calif. Headquarters, Del Coronado. Chairman, Mrs. Lucie Spence Murphy, Milwaukee Downer College, Milwaukee, Wis.

Nov. 3–7. International Lighting Exposition at Chicago, Ill. Headquarters, Stevens Hotel. Chairman, E. C. Juerkamp, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland 15, Ohio.

Nov. 6–8. Wisconsin Industrial Arts Association, at Milwaukee, Wis. Secretary, H. J. Shufelt, City Hall, Racine, Wis.

Dec. 15–18. American Vocational Association, at Los Angeles, Calif. Headquarters, Biltmore Hotel. Secretary, L. H. Dennis, 1010 Vermont Ave., S.W., Washington 5, D. C.

Dec. 15–18. National Council of City Administrators of Vocational Education and Industrial Arts, at Los Angeles, Calif. Headquarters, Biltmore Hotel. Secretary, Frank Huffaker, 215 Chestnut St., Chattanooga 3, Tenn.

Dec. 26–31. American Association for the Advancement of Science, at Chicago, Ill. Headquarters, Sherman Hotel. Secretary, Dr. F. R. Moulton, 1515 Massachusetts Ave., N.W., Washington 5, D. C.

▶ This Month's Cover

The illustration chosen for the November cover of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION shows a student at the band saw in the woodworking shop of the Senior High School, Tucson, Ariz.

The picture was submitted by Harry G. Goldstein, instructor of photography at the Senior High School, Tucson, Ariz.

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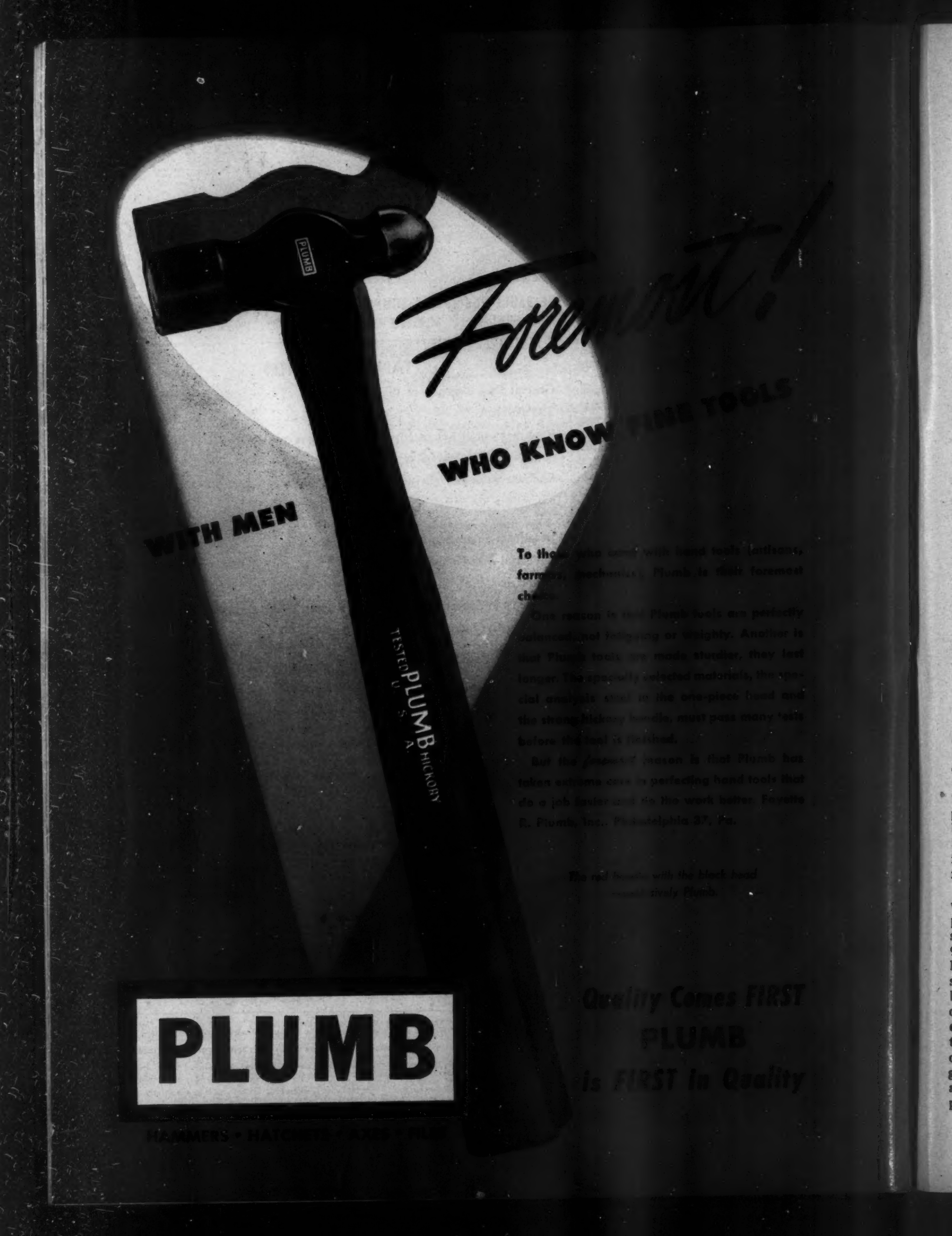
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NOVEMBER . . 1947

General Shop Teachers of Illinois

CLARENCE O. BIDDLE
Instructor of Industrial Arts
Chicago Teachers College
Chicago, Ill.

In the midst of great industrial change which promises to become rapidly and progressively greater within the next few years, it appears that a state-wide personnel study of the present status of the general shop teacher should be significant.

Large industries, corporations, and organizations know the status of their employees, and many maintain special research departments to study their situations annually. Education might well follow business methods in determining teachers' status.

There are one hundred and fifty industrial-arts general shop teachers in the state of Illinois. Accordingly, a questionnaire was prepared and sent to every general shop teacher who was listed in the 1945–46 Illinois School Directory. One hundred and eight questionnaires were returned. Of this number eight were discarded, either because they were not filled out completely or because they had been answered by teachers who taught only unit shops. Sixty-six and two thirds per cent of the inquiry blanks sent out were used in the final tabulation of the results.

One of the main purposes of this survey was to determine the amount and kind of professional study done by the general shop teachers of Illinois. It was found that 97 per cent of the general shop teachers had been graduated from an approved institution of higher education, and held the bachelor's degree. Three per cent, consequently, did not hold such a degree. Seventy eight per cent of these teachers obtained the bachelor's degree before 1939. Seventy-one per cent of all Illinois industrial arts general shop teachers majored in industrial arts as undergraduate students. Twenty per cent majored in education with 30 semester hours or more devoted to the industrial-arts field.

In a further analysis of the nature and amount of the professional study pursued, it was found that a few general shop teachers had credit for only six semester hours in education. Others had as many as 80 and even 90 semester hours in this field. Ninety-five per cent of the general shop teachers had had a course in teaching methods in industrial arts. On the other hand, 28 per cent reported that they had received no instruction in vocational guidance. The median of semester hours in industrial arts was shown to be 38.83.

Using the suggested college preparation of teachers of industrial arts set forth by the University of Illinois[1] as a criteria for judging the undergraduate preparation of the general shop teachers in woodworking, metalworking, electricity, mechanical drawing, and architectural drawing, it was found that but 4 per cent of the group of one hundred teachers had superior qualifications. These four teachers were superior in the field of woodworking. Of the teachers questioned it was found that 12 per cent in woodworking, 46 per cent in metalwork, 86 per cent in electricity, 14 per cent in mechanical drawing did not meet the minimum requirements. Moreover, 34 per cent had not studied any biological science; 28 per cent had no credit in the field of mathematics; 14 per cent did not have sufficient semester hours' credit in social science; while 12 per cent had not studied any physical science while in college.

Graduate Work

The realization that four years is scarcely enough time in which to prepare satisfactorily to teach industrial arts, has caused leaders in industrial-arts education to welcome the opportunity of adding a fifth year of graduate study leading to the master's degree. It is because of this movement that it was thought well to determine the amount and kind of graduate work already accomplished by the Illinois general shop teachers. We found that 84 per cent of the teachers have had some graduate work, while 16 per cent have done no graduate work at all. Twelve per cent of the general shop teachers in Illinois have received the master's degree majoring in the field of industrial arts. Twenty-four per cent majored in the field of education. These two groups constitute the 36 per cent who have received the master's degree.

The University of Illinois, Indiana State University, and De Paul University attracted the greatest number of general shop teachers to do graduate work. Ninety-two per cent of the general shop teachers believe that all universities should offer more advanced courses in industrial arts at the graduate level. Of that number, 60 teachers suggested that the theory of shopwork be offered at the graduate level. No one suggested actual courses in shop practice at the graduate level. Shop organization and shop program and curriculum making were also suggested as courses which could be offered in the graduate school.

Experience

There are very few general shop teachers in Illinois with an undergraduate major in industrial arts who have not had at least four years of teaching experience in some branch of industrial arts. Twenty-six per cent of these teachers have from 10 to 14 years of teaching experience. Thirty-three per cent have over 15 years of such experience.

However, in the field of practical shop experience, the results of the findings were rather discouraging. In the fields of aviation, printing, electricity, and auto shop, from 88 to 97 per cent of the general shop teachers had no practical experience. A very few had over three years of practical experience in woodwork or metalwork. Of the 100 teachers for whom experience is tabulated, it was found that 76 per cent of them had taught in the grade schools.

[1]The Recognition and Accrediting of Illinois Secondary Schools, p. 4. University of Illinois Bulletin, June 9, 1939.

The median for length of service in the grades was found to be 2.21 years. The median in years for length of service in high school was found to be 10.92. The median for all teaching experience, both in the grades and in high school, is 16.26 years.

Organization of General Shop Work

Since industrial-arts and general shop classes are planned as an integral part of any well-rounded high school program, it becomes necessary to present the following facts concerning the organization of general shop classes. The clock hours devoted to this type of work ranged from 10 hours in three cases to 45 hours in one case. The median in clock hours per week was found to be 28.71. The range in time of general shop class periods was not as great as the range in time devoted to unit shopwork per week. Thirty-three per cent of the schools replied that the shop class periods were of 40 minutes' duration. Twenty-one per cent of the schools have class periods which are 45 minutes long, and 20 per cent have 60-minute periods. The remainder of the schools (26 per cent) have periods ranging from 42 to 57 minutes in length. All of the schools have double periods daily. The median in number of students taught daily was found to be 86. Few girls are enrolled in general shop classes. Seventy-seven per cent of the teachers reported no girls enrolled. In the remaining 23 per cent of the schools, the girl enrollment varied from 1 per cent in one school to 25 per cent in two schools. General shop work was found to be offered generally in the ninth and tenth school years. Woodworking, metalwork, and mechanical drawing compose the units of instruction most commonly offered in the general shop courses. Forty-four per cent of the general shop teachers suggested changes in the choice of the present units of instruction to include auto mechanics, printing, bookbinding, plastics, farm mechanics, and craft shop. Seventy per cent of the general shop teachers have extracurricular activities and 20 per cent of these 70 teachers find these activities burdensome. Athletics heads the list of extracurricular work. Other types of extracurricular activities performed are: class sponsors; construction work for the school's dramatics; department heads, teaching adult classes; and having charge of the school's yearbook.

Teaching Aids

Of the 100 shop teachers questioned, 58 stated that the shop room was unsatisfactory for instructional purposes. Too small rooms, too few work stations, poor lighting, poor ventilation, insufficient heat, dampness, lack of storage space, poorly arranged shops, insufficient supplies, basement rooms, and rooms in need of soundproofing, were listed as conditions preventing good instructional organization.

It was found that all schools in which general shop classes are offered, subscribe to vocational magazines for both student and teacher use. The INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine was the periodical subscribed for by the majority of school libraries.

Recommendations

The recommendations deemed advisable by the author are as follows:

1. General shop teachers should be required to take a minimum of three courses in guidance, one of which should be vocational guidance.

2. Undergraduate study in the fields of biological science, mathematics, and physical science should be required as supporting courses to the work in industrial arts.

3. The present general shop teacher, in order to comply with the recommendations offered by the University of Illinois in 1939, should take more courses in metalwork, electricity, architectural drawing, auto mechanics, and aeronautics.

4. It is suggested that the general shop teacher major in industrial arts during his undergraduate and graduate study.

5. Four years of undergraduate study is not sufficient preparation in the field of industrial arts. Institutions offering an undergraduate curriculum in industrial arts should add a fifth year for graduate study leading to the master's degree.

6. For those shop-teachers who are taking in-service training, it is suggested that they confine their work to new industrial practices and problems.

7. Seventy-five per cent of the Illinois general shop teachers have no practical shop experience. Judging from the findings of others who have studied the question of practical experience and from the author's own experience, it would seem justified that general shop teachers have at least two years of varied shop experience. College credit could be allowed for this work.

8. Admittance to high school courses in general shop should not be denied on the basis of sex.

9. General shop courses should be so organized that girls may find the work profitable and interesting.

10. General shop courses are exploratory in nature and if they are offered in the senior high school should be presented during the ninth or tenth years and not later. Older pupils ought not to be placed into shop courses, because they are lacking in credit.

11. The units of instruction should be chosen on the basis of modern industrial trends, local needs, ability, and interests. Some of the following units ought to be included: art metal, printing, textiles, aeronautics, plastics, ceramics, drawing — reading and design, and transportation.

12. The present extracurricular activities of the Illinois general shop teachers are too numerous and of the wrong type. Shop teachers ought not to coach athletics above all else. The extracurricular activities should be those which have avocational or occupational values.

13. From the author's own experience, and from the numerous proposals offered by the respondents, it is suggested that shop rooms be so constructed as to be bright and colorful, well ventilated and well lighted. Student health, interest, morale, and skill depend upon these conditions.

14. The present general shop teacher must have more time to guide youth, in order to help students to understand the basic framework of our industrial civilization. With the present limitations of assigned periods, it is doubtful if this extra time can be found.

THE TEACHER

LEONARD E. SCHMIDT
Lincolndale, N. Y.

As you watch your boys attempt
To do the things you do,
And "ape" each move that you may make,
Has it ever occurred to you
That you hold the power to set their ways
Along the paths ahead?

It's a privilege each teacher has —
An obligation too;
For what they learn, and what they do
Depends a lot on you.
So take a little extra care
With those who follow in your stead.

Think more than once before you act,
Weigh every move you make,
Forget not for a moment that
Their futures are at stake.
Then later you may proudly say —
They followed where I led.

Approximately 250,000 finger injuries, 60,000 toe injuries, and 75,000 eye injuries of a disabling nature occur annually in occupational accidents. Of these, 25,000 finger injuries, 3500 toe injuries, and 5000 eye injuries are of a permanent nature. — *National Safety Council.*

Co-ordination of Related Instruction for Apprentices

A. D. MATHISON
Milwaukee Vocational School
Milwaukee, Wis.

This article will reflect the experiences which were gained from administering, with other co-workers, the National Defense Training Program, the War Production Training Program, and now the related training programs for G.I. apprentices and on-the-job trainees. Five years ago we were all working together to win the war. Now, five years later, we are engaged in the battle for peace and freedom. My experiences during that period were largely administrative in character because I shared the responsibility for the over-all outcomes of the educational programs which were conducted by the school. The handling of the subject in this article, consequently, will differ from the way it would be presented by a specialized vocational school co-ordinator.

The Meaning of Co-ordination

What is meant by co-ordination? Is it thought of in terms of adjusting vocational courses to the needs of business and industry? Or is it thought of in terms of supplying the school with data essential for curriculum planning? The writer likes the concept of co-ordination which calls for harmonizing all of the factors which affect related instruction in the school. The act of co-ordinating, in his opinion, should be achieved through democratically planned co-operation by all persons concerned in the solution of specific co-ordination problems.

Techniques vs. Principles

Since this article calls for the discussion of techniques in co-ordination, it might be well to stop and consider whether or not principles of co-ordination should not be considered first. A technique is a specific way of doing something. Since the conditions under which any two of us work while performing the act of co-ordinating may differ from day to day, we are not assured that particular technique will always work. A principle is a generalized statement through which data are systematized and interpreted. Through principles we have a way of controlling the doing of things: for example, the selection of the proper technique. Since we are charged with administering the related instructional program for apprentices and on-the-job trainees, we must rely on techniques; otherwise the job could not be done. The writer recognizes that principles are more fundamental and he shall not, therefore, attempt to prescribe techniques which will work in all situations. Every educator should be free to develop his own techniques through the intelligent application of principles.

Over-all Planning

The act of co-ordinating is a complicated process. Educators in vocational schools, colleges, universities, and technical institutes are too well aware of the many items which must be considered. Recruiting new teaching personnel, expanding school plant, instructing groups of learners with varied military experiences, extending the number of trades to be served, keeping instruction geared to the needs of business and industry; these are but a few of the items which have created problems for vocational educators. To solve these problems there must be over-all planning.

The construction of a master plan should be carried on under the direction of the administrative head of the school. In Wisconsin, this responsibility lies with the director of the local school of vocational and adult education. His technique in creating a plan will depend upon the size of the school and its administrative organization. In principle his plan should reflect the combined judgments of his colleagues who know the specialized needs within the total situation. In Milwaukee the vocational school director, Dr. William F. Rasche, in regular meetings with the faculty counselors of the line divisions of the school, has determined the needs for related instruction and has outlined the school's policies in meeting those needs.

The execution of the master plan was delegated to a central committee composed of the line and staff officers directly responsible for the related training programs for apprentices and on-the-job trainees. This committee has had regular meetings at which contributions have been provided by both line divisions and staff departments. The plans agreed upon for promoting the related instructional program are based upon free discussion and are approved by all concerned. The members of this central committee proceed with their own plans to execute their part of the program in harmony with the over-all plans for the school.

Keeping Related Instruction Geared to the Needs of Business and Industry

Is the attainment of this objective the sole responsibility of the specialized co-ordinator? He is vitally concerned with this objective because he uses all of the techniques at his command to tie together the work of the school and the activities of the learners at their places of employment. He cannot, however, achieve this objective alone. He must team up with the others who share the responsibility for integrating the work of the vocational school with business and industry. Who are these others?

Ranking high on the list is the trade instructor. He has the responsibility of instructing the apprentices and on-the-job trainees. In our school, he has the added responsibility of being the adviser to the apprentices in his trade. In that capacity, he approves the curriculum for the trade and sees to it that the apprentices are advancing progressively through the courses which make up the curriculum. Unless he keeps abreast of new developments in his trade, the instruction in his area will not be geared to meet the needs of industry. Which techniques are to be used to keep the trade instructor in step with business and industry? I'm sure professional trade instructors will be able to answer that question readily. Their answers would include the following: holding membership in and attending the meetings of their trade organizations; visiting industry periodically; participating in trade conventions; serving as consultants or on advisory committees; reading the magazines of the craft; keeping on the mailing lists of manufacturers and publishing houses which serve the industry; and encouraging apprentices and on-the-job trainees to make reports on new developments in the trade.

A second important force in keeping related instruction geared to the needs of business and industry is the employer. What techniques are to be used to secure his help in promoting the instructional program? The arrangement of conferences with the proper plant executives to discuss training problems is a technique which has been used effectively by our apprentice co-ordinator. This technique was used to revise the curriculum for the mechanical

draftsmen apprentices of the Milwaukee firms served by our school. Sending form letters to the employers of on-the-job trainees requesting them to recommend specific courses for their trainees has been another means to help assure proper related instruction.

A third important agency, the local advisory committee, composed of an equal number of representatives of employers and employees, can also be very effective in keeping related instruction geared to the needs of industry and business. What techniques should be used to get the help of such committees? In new trade areas we have found these committees very helpful in giving the school advice on curriculum content and recommending to the school the names of competent journeymen who might qualify as instructors. Recently, related programs and instructors were provided, through the co-operation of such committees, for the glaziers, soft tile and linoleum layers, operating engineers, and structural draftsmen apprentices. And even in those trades where the school has been providing related instruction during the past quarter century, these committees are very helpful in making suggestions for revisions in existing programs. Our technique has been to provide each committee member with a set of course descriptions, outlines of instruction, and student progress records for all the courses taught the apprentices in the trade. The committee are then fully informed about the related school program and are in a position to make constructive criticisms. Too often employers, labor, and other co-operating agencies make the same mistake that many parents do: they form opinions about the school which are not based on facts but rather on the assertions made by students and others who do not, at the time, see the value of related training. The technique to use to counteract such charges is to bring the facts to those who are misinformed and to continue to maintain high educational standards within the school.

And then there is the Wisconsin Industrial Commission, the authorized agency to administer the apprenticeship law. This commission can be very helpful to industry and business by calling upon a school representative to assist when a contract is drawn or an on-the-job training agreement is made for a new trade. At that time many of the problems concerning the related instruction to be provided by the school can be worked out.

Aside from co-operating with other groups, there are many other techniques for harmonizing the related instruction program to meet the needs of business and industry. One very effective technique has been to have line and staff representatives of the school attend conferences of personnel workers in industry, employers' conferences, and meetings of labor organizations. Another technique has been to have the school participate in radio programs and to prepare exhibits showing the work being done by the students.

Acceptance of Related Instruction by Apprentices and On-the-Job Trainees

What assurance do we have that apprentices and on-the-job trainees are sold on related training? Do our schools employ student personnel practices which gear the instructional program to student needs, interests, and abilities? What provision is made for student participation in the total program? In brief, do students accept the program?

There are many techniques which will go far toward bringing about the acceptance of our programs by the apprentices and on-the-job trainees. Some of the practices introduced at the Milwaukee Vocational School, follow.

We firmly believe that the proper induction of the new apprentices is the first step in selling them on related instruction. This responsibility is assigned to our apprentice guidance counselor. He arranges with the apprentice co-ordinator to have the apprentice report to school on the day most convenient to the employer and the school. Before assigning new apprentices to the testing department, he has a conference with them at which he carefully reviews the philosophy of the Wisconsin Apprenticeship Plan, the objectives of related instruction, and the reasons for administering a scholastic aptitude test, subject-matter placement tests, and the filling out of a student questionnaire. Following the testing, the new apprentices are taken on a tour of the building. This is obviously a necessity at our school because of its size. In addition to informing the new student about location of shops, classrooms, cafeterias, nurse's office, etc., it gives him an insight into the scope of the total educational program and his place in it. At the end of the tour, the new apprentices again meet with the guidance counselor for another conference. Each apprentice is given a copy of the curriculum for his trade and a copy of his program of studies. The guidance counselor carefully explains the plan of instruction, placing particular emphasis on the apprentice's responsibility for co-operating with his trade adviser in making progress covering the specific unit courses in the curriculum. The student handbook is discussed and apprentice's questions are answered. Before the apprentice reports to his classes during the following week, his teachers will have received the test results and a copy of a questionnaire which details his educational and military background. This information enables each teacher to gear his instructional program to the needs and capacities of the new apprentice.

Through the school council organization, the apprentices are given an opportunity to participate in the total school program. Through his elected class officers, his suggestions for improvements in the school program can reach the school director's desk.

In addition to the school council organization, many valuable suggestions for improvements in the related instructional program can be secured from veteran's organizations, which operate within the school.

The assembly program, films, talks, etc., are other mediums for keeping the students informed about the school's instructional program.

The New Instructor

The recruitment of qualified instructors to teach the increased number of students and on-the-job trainees has been a difficult task for all schools. It has been particularly difficult for vocational schools, because of competition from business and industry, to get the services of competent journeymen having the necessary educational background which would qualify them as instructors. But, having engaged the instructor, the school has the added responsibility of training him for his teaching job. This must be done thoroughly and carefully if the new instructor is to direct effectively the learning of the apprentices and on-the-job trainees. What are some of the techniques that have worked effectively in orienting new instructors to their work? Again, the practices of the Milwaukee Vocational School are used as examples of techniques that have worked successfully.

New instructors who have not had the benefit of teacher training are required to take a course in "Applied Methods of Teaching Vocational School Subjects." Under the direction of the teacher trainer, Wm. A. Brazier, the new teachers have weekly conferences at which they work to achieve the following objectives: (1) gaining an appreciation of the instructor's job, (2) becoming familiar with the four-step instructional process, (3) securing an appreciation of the need for making preparation to give instruction, (4) becoming familiar with some of the fundamental principles of learning, (5) securing an appreciation of common learning difficulties, (6) becoming familiar with the fundamentals of organizing instruction, (7)

becoming familiar with the various types of instruction sheets and how to use them, and (8) becoming familiar with the various types of visual aids, their selection and uses. To give the new instructor an opportunity to apply the theory acquired in the course, he is required to give four demonstrations in his classroom under the observation of his faculty counselor. These demonstrations include: (1) instructing an individual; (2) a simple group demonstration; (3) the use of an instruction sheet; and (4) the use of motion picture films. The faculty counselor fills out an observation check sheet for each demonstration and has a conference with the teacher and teacher trainer during which the teacher's techniques are evaluated.

The new teachers who have had the benefit of teacher training are required to take an in-service training course covering the vocational education movement, and specifically the Milwaukee Vocational School. Through readings, seminars, and individual conferences the new instructors are given an understanding of the history of the vocational movement and an understanding of the history, organization, and philosophy of the school, particularly as it applies to the teacher and to the organization of his daily work.

In addition, the faculty counselor works with the new instructor through periodic group meetings, individual conferences, and classroom visits, thus assisting him to gain professional growth and acquiring efficiency.

Leadership of the Staff Specialist

A discussion of the techniques in co-ordination would not be complete without considering the responsibilities of staff specialists for providing leadership to educators who conduct related instructional programs, for apprentices and on-the-job trainees. These specialists are not limited to those who work in the schools, such as apprentice co-ordinators, administrative assistants, psychologists, curriculum specialists, librarians, guidance counselors, veterans' co-ordinators, etc. Also, included in their ranks are the specialists who work at the national and state levels in the field of vocational and adult education and civilian rehabilitation. There are those who are employed by the Veterans Administration and who have responsibilities for training at the local level. In addition, there are the specialists who are employed by the Federal Apprentice Training Service, whose work affects the related instructional program of the school. All of these specialists are experts in their respective fields. Vocational school administrators and co-ordinators need their professional advice and assistance.

Development of Desirable Human Relationships

It has already been stated the act of co-ordination should be achieved by the planned co-operation of all concerned. This naturally includes the harmonizing of the human factors involved. The apprentices at our school take a formal course in which the socioeconomic problem of interest and concern to workers in our democratic society are studied. Some of these problems are: (1) cultivation of ideals and attitudes, (2) how to co-operate on the job, (3) the American way of life, (4) production in industry, (5) collective bargaining, (6) unemployment compensation, (7) free enterprise, etc. Through his study of these problems, the apprentice learns to recognize his responsibilities to his fellow workers, his employer, and his community. This course is taught to all of our apprentices because of our belief that purely mechanical training is insufficient in good apprenticeship.

We are now engaged in a battle to maintain freedom and peace on an international scale. Nationally we are having the pains of reconstruction from a second world war. As educators in a democratic society which stresses the dignity and worth of the individual, we must create new techniques which will develop desirable human relations based on human rights and responsibilities.

"Forecast of the Future"

This prize winning photograph submitted in the 1947 National High School Photographic Award contest was taken by Roland Rippel, a student in the Metropolitan Vocational High School, New York, N. Y.

Army and Navy Mock-ups

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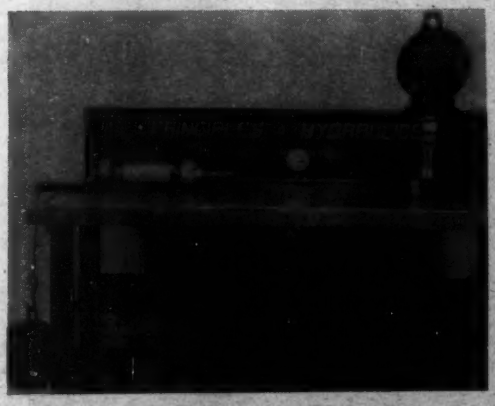
The Army and Navy Training Program has been carried on with so large a degree of success because the armed forces adopted, improved upon, and developed the factors of two dominant principles of education. In the first place, the students learn "by doing and observing." Lectures are kept to a minimum. Theory is taught only when it is absolutely necessary for general comprehension of the specific task involved. Performance of the actual project is the center of all interest and effort. All the incidental steps are eliminated. In the second place, all of the students' senses are employed in the learning process. Auditory and visual aids are constantly employed. Sound and color motion pictures, film strips, steroptic views, charts, drawings, diagrams, posters, and instructor demonstrations are the basic implements of the education. These various means are never presented as isolated factors of instruction but they are woven together for use in any one class presentation. It is customary to introduce from three to five different visual aids into a lesson. Even the kinesthetic and olfactory senses are used wherever possible.

The concept of "learning by doing" is carried out to the fullest. It is applied even to the most complex subjects. For example, in teaching the principles and operation of an aircraft engine, the instructor lectures and demonstrates for about two hours. The students then work on cutaway engines, exploded views of engines, and individual unit mock-ups. They study charts, drawings, and diagrams which are located on the walls around the room or on stands next to the engines. Under the instructor's guidance, the students carry out the various projects and work on the actual material for approximately forty hours. At the end of that time, they take tests to ascertain their mastery of the subject and between 95 and 97 per cent of every class pass the examination.

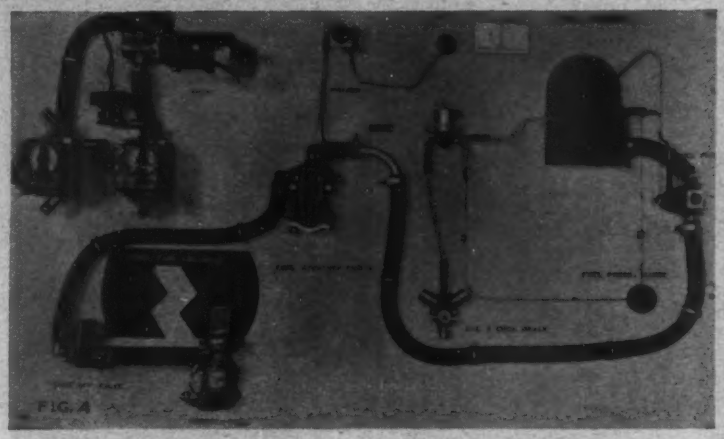
Another illustration is the method used in teaching the infantry soldier how to shoot a rifle. He begins by learning how a well-sighted rifle looks. All around him are posters showing a bull's eye floating in the center of a circle just above the front sight of a rifle. He memorizes that picture and practices adjusting a pair of sights mounted on a wooden bar until they made the same figure. He learns to take a gun apart and clean it. He constantly practices squeezing the trigger smoothly. He mounts the rifle on a wooden stand, practices drawing a bead on a paper target, and marks the exact spot where his sights point. When he can sight three consecutive points close enough to be covered by a pencil eraser, he is graduated to sighting at actual targets on the rifle range, taking aim from different positions and different distances. All this is "dry run" practice without any ammunition. Before he is given live ammunition, he is given constant lessons in safety. He is shown motion pictures depicting correct procedures and the results of carelessness. Dramatic and drastically vivid posters are placed at every point of vantage. Consequently, when after several weeks he is finally given ammunition for his gun, he is careful and makes a good score even on the first rounds.

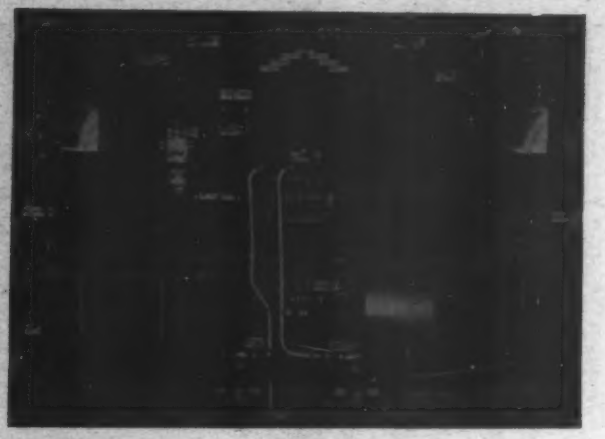
The army air forces, thinking that certain of its training aids were more effective than others, set up a table for apportioning class time in accordance with this study. The material was listed in the order of its importance as follows: mock-ups of all types; exercise and work project sheets; charts, graphs, and models; training films, slide films, and film strips; posters; and blackboard discussion. Although the time ratio varied with different types of subjects, all of the equipment emphasized student participation and the extensive use of visual aids. It definitely minimized the use of lectures. It clearly showed that the most important training aid was the mock-up.

The term mock-up has become firmly entrenched during this war. Its exact derivation is unknown, but its meaning is definite. A mock-up consists of any training device which uses actual equipment in the presentation of a lesson. Some of the major types of mock-ups are as follows: complete hydraulic systems mounted on panels so that the entire material can be assembled as a unit in a limited space; complete external lighting systems of an airplane, embodying all of the lamps, switches, relays, solenoids, etc.; operational cutaway engines which are turned by a



Figs. 1, 2, 3. Hydraulic systems
(a) Practical application of Pascale's Law. (b) All the principles of hydraulics. (c) Function and operation of all the units: reservoir, pump, system relief valves, check valves, pressure regulating valves, bleeder valves, hydraulic pressure gauges, actuating arms, and actuating cylinders. (d) Flanging of hydraulic tubing. (e) Strut assembly inspection, maintenance, and repair. (f) Hydraulic press work.





Figs. 4 and 5. Fuel and transfer system

(a) Function and operation of each unit in a fuel system and the transfer system. (b) Complete assembly, disassembly, throttle and mixture settings, and maintenance of carburetors. (c) Complete preflight and daily inspections of any fuel and transfer system. (d) Operation and maintenance of fuel warning and primer systems. (e) Fuel pressure gauge operation and maintenance. (f) Fuel line, hose, and clamp connections. (g) Principles of fuel injection.

motor through a reduction gear so that the students can watch the actual operation of every part of the engine during its normal motion; cutaway superchargers, fuel pumps, carburetors, propeller assemblies, magnetos, etc., so that the students can quickly study the assembly, function, and operation of these units and their individual parts; and all types of "breadboards" on which the major units of any system, especially electrical, are mounted without any connections and the students make all the necessary connections in order to make the systems function. These mock-ups vary in size from a small selector valve which is about the size of an ordinary drinking glass to the entire wing or fuselage of a B-17 airplane. They may be used to teach one exact task on one specific ship or they may be used to teach general principles or laws of physics. The important feature is that regardless of their teaching use, they all embody the actual operational units involved in the general occupation or "job" to be taught. Furthermore, every one of these mock-ups works exactly as it does under normal operational conditions and the students do all the maintenance, trouble shooting, assembling, and disassembling of the mock-ups. These mock-ups constitute the greatest step in the development of a training device entirely based on the principle of the student's "learning by doing."

The real significance of these mock-ups is that they can be easily applied to the teaching of any secondary school subject. There is practically no law in physics which cannot be illustrated by a well-designed mock-up. Some of the major principles of chemistry can be learned from mock-ups. Of course, practically everything taught in any vocational shop can use this method of teaching; for example, there could be complete mock-ups of house wiring systems, plumbing systems, heating systems, etc. Instead of teaching simply different types of carpentry, the classes could be assigned the project of constructing a miniature house which would involve every phase of the carpentry trade and this project could then be used as a mock-up for repair and maintenance work or it could be torn down and rebuilt by every class. All that these mock-

Figs. 6 and 7. Magneto and ignition system

(a) Operation, function, assembly, and disassembly of magneto. (b) Complete principles of "firing hot spark." (c) External and internal timing of a magneto. (d) Complete trouble shooting of an ignition system. (e) Principles of induced current; primary and secondary coils. (f) Principles of condensers.

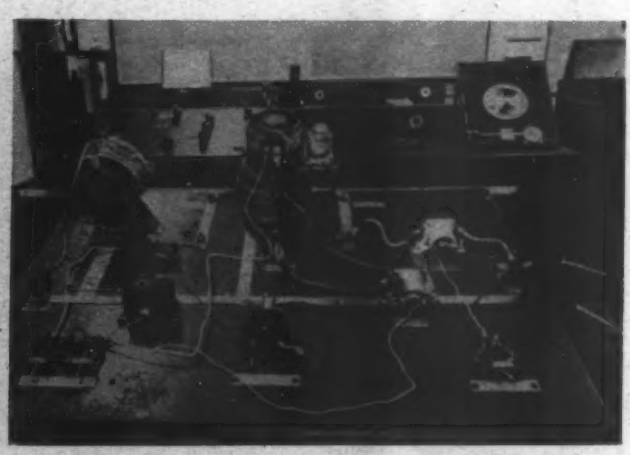


Fig. 8. Starter system

Fig. 8. (a) Operation, function, maintenance, inspection, assembly and disassembly of starters. (b) Trouble shooting and repair of complete starter systems.

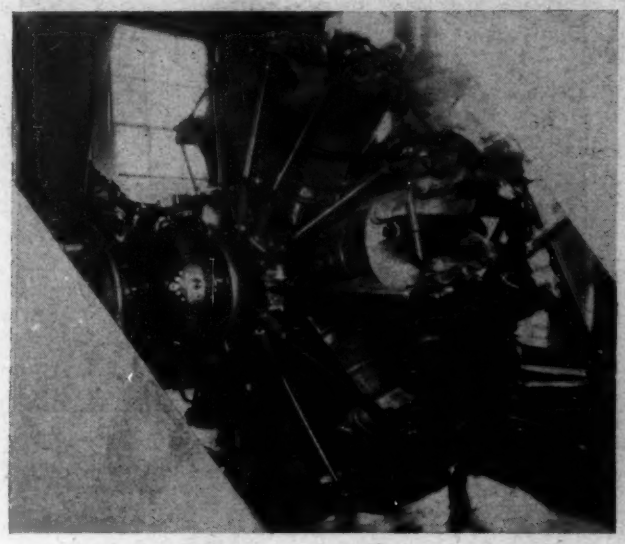


Fig. 9. Operational cutaway radial engine

(a) Principles of any combustion engine, especially the four-cycle engine. (b) Change from reciprocal to rotary motion. (c) Principles of valve overlap. (d) Principles of planetary reduction gearing. (e) Cooling systems: air and oil. (f) Operation, function, maintenance, repair and inspection of radial engine.

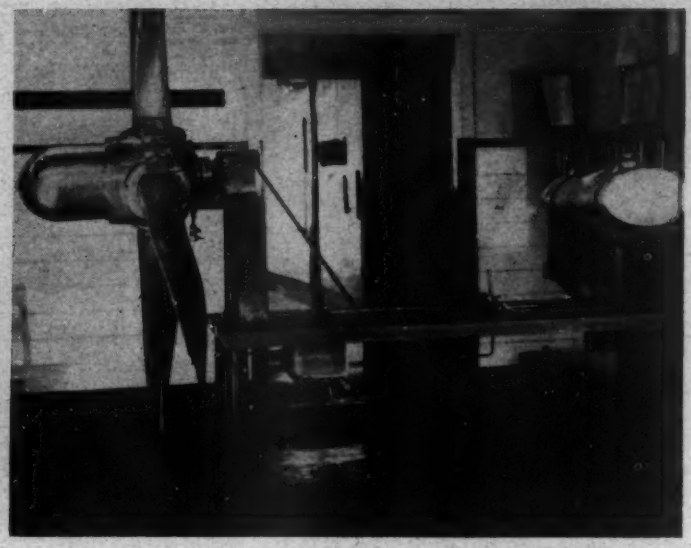


Fig. 10. Hamilton hydromatic propeller

(a) Complete operation, maintenance, assembly, disassembly, trouble shooting, and repair of this propeller. (b) Preflight and daily inspections of the propeller, anti-icer system, and feathering system. (c) Aerodynamic principles of propeller action.

ups require is a little ingenuity and imagination on the part of each instructor. The extra time it takes to construct the first mock-ups will be amply repaid by student interest and the ease of presenting the subject for future lessons. The moment the students realize that they are studying on practical, operational equipment, are solving everyday problems, are actually performing real maintenance work, and are learning rules, principles, or laws which apply to their own daily existence, the problem of motivation and student interest is practically solved. Furthermore, the students probably learn and retain more information because they have "learned by doing."

The integration of visual aids and the use of mock-ups is almost entirely responsible for the success of army teaching methods. This is true because the army failed to capitalize on any other factor. About 90 per cent of its teaching personnel had never been teachers and knew nothing about methods, theories, philosophy, or psychology of teaching. About 50 per cent of the administrators were not trained educators. The syllabus for each course was so rigid that the instructor was given no opportunity to account for individual student differences. Absolutely no direct attention was given to any student motivation. Physical difficulties were accentuated by running classes for 24 hours per day so that certain groups attended school for months from midnight till six in the morning. Squadron duties, such as drills, kitchen police, personal inspections, barrack details, etc., frequently preceded classes so that the students were too tired to remain awake. Such conditions were cured by removing all seats from the classrooms so

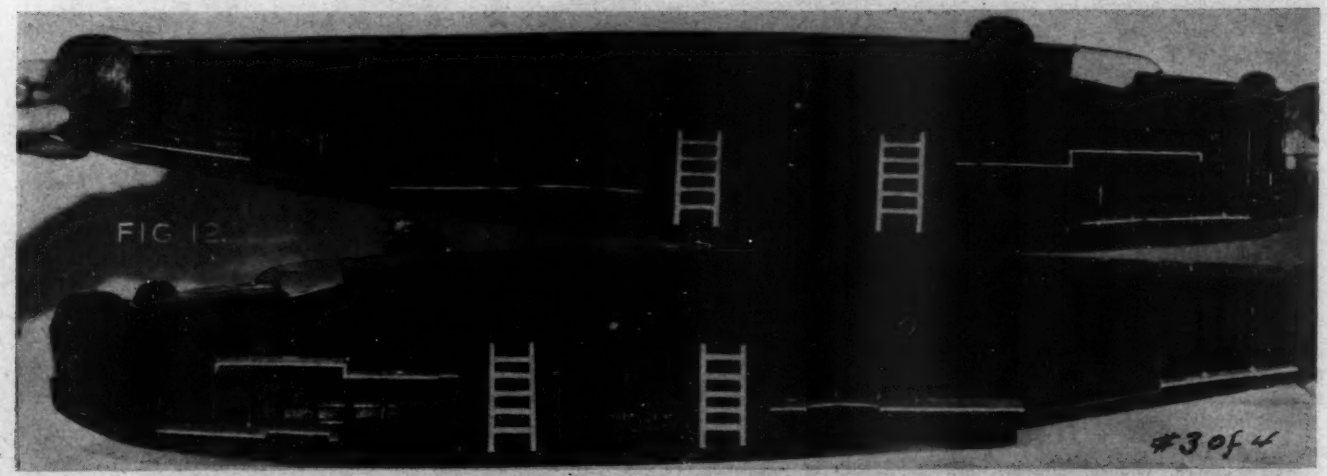


Fig. 12. Load and balance mock-up

(a) All the principles and laws of balance, moments, and stress and strain. (b) Use of a loadometer (type of slide rule) in order to correctly load a plane to maintain correct weight and balance. (c) Internal structure of a plane.

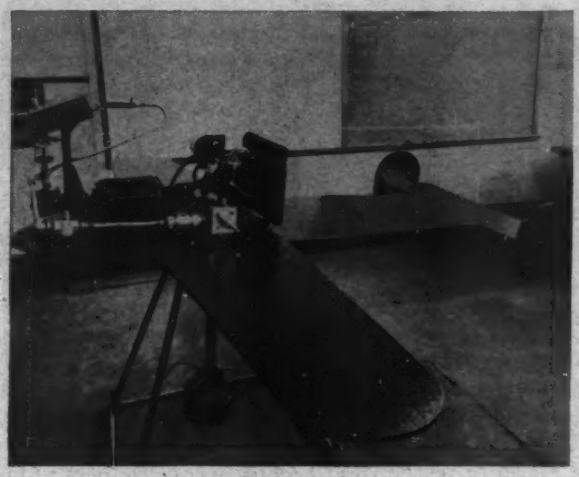


Fig. 11. Gyroscopic instrument — movable table
(a) Complete principles of any gyro. (b) Operation, function, maintenance, repair and inspection of gyro compass, turn and bank indicator, and artificial horizon.

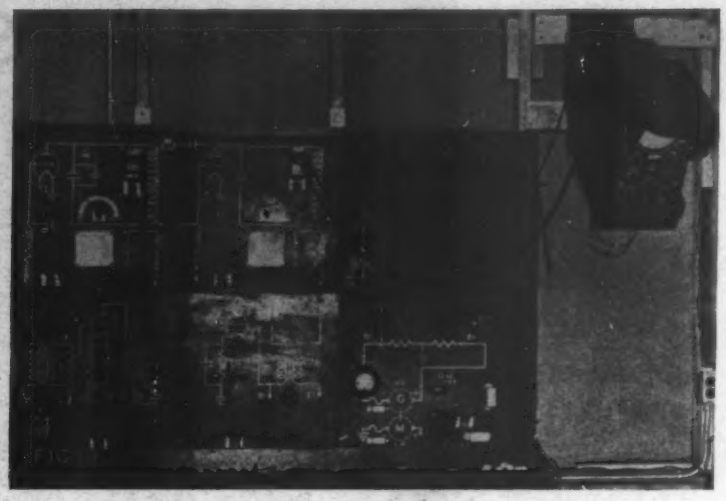


Fig. 13. Simple flexible transmitter stages
(a) Wiring diagrams. (b) Parallel and series circuits. (c) Operation, function, maintenance, and repair of major electrical units such as: transformers, resistors, transmitters, ampmeters, ohmmeters, voltmeters, etc.

that sleeping became almost impossible. Yet, under these conditions the soldiers learned to do their jobs. The success of the military schools cannot be attributed to any other cause than the use of all types of visual aids and the exceptional development of the mock-up.

Since the integrated use of visual aids and more specifically the use of mock-ups have solved one of the greatest training problems America had to face and since they were proved successful in the hands of inexperienced personnel, it is safe to assume that they can be used to much greater advantage by trained civilian educators. The use of mock-ups in the average secondary school course would in no way change any of the present procedures in the broad sense of the term. These mock-ups would merely be an adjunct to the methods and techniques already in use. They would merely constitute a more practical visual aid and a more energetic student participation in the learning process. They would help student motivation and create the "drive" necessary in all successful teaching.

Characteristics of Well-Designed Metal Projects

HOMER C. ROSE
Alexandria, Va.

A project designed for the school shop must meet several objectives. Not only should the project be desirable in itself but it must involve the use of a wide variety of tool operations without too much emphasis on any one operation. The suggested projects in this series have been designed to give the student the maximum experience with metal and metal-working tools consistent with good design. A second objective is to provide the student with plans for desirable objects which he will be proud to own. The following beliefs have been the guideposts while designing these projects.

Pleasing in appearance. Good shop projects should be attractive and interesting. Some may follow traditional lines, but in general they should indicate that the designer is aware of and capable of following modern trends. We must not encourage students to make things already to be found in their homes.

Useful and practical. The project should meet a need. It should be so designed that it can be used either by the student himself or as a practical and desirable gift. Some projects should be so well designed and constructed that they can be sold at a profit to the student. This is consistent with one of the broad objectives of industrial education which is to give the student an understanding of the industrial world in which he lives.

Within the range of student ability. The design of the project should be such that the average student will encounter only a reasonable amount of difficulty in its construction. It is the teacher's responsibility to guide the student in the selection and design of a project to fit his ability and skill. Bad habits and bad attitudes are inevitable when a student is allowed to start a project beyond his ability or which cannot be constructed in the time allowed and with the equipment available to him. Every opportunity should be taken to encourage students to modify basic designs in terms of their individual creative abilities.

Constructed with common tools and according to standard procedures. It is important that, as far as possible, standard procedures, reflecting good trade practice, be employed. Some jigs and fixtures are recommended since they represent modern industrial practice and lead the student through a more rounded experience. Standard tools should be used as much as possible and always according to sound and safe trade practice.

Constructed of modern materials. Not only should modern materials be used but the natural beauty of each material should be emphasized, not hidden. The design should make use of the natural working characteristics of the material and when another material of different characteristics is used it is frequently desirable to change the design. The imitation of one material with another leads to poor design.

Organizing Technical High School Woodworking Courses

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Dorchester, Mass.

The primary purpose of education is to develop young people into happy, useful, and successful citizens. A happy, useful, and successful life involves the possession of certain desirable ideals, attitudes, habits, and accomplishments. The whole purpose in the activities of teachers is to produce these favorable changes in individual pupils and to do it in the most effective and economical way. Every change in the individual must come from experiences and interpretations. If a specific change is desired, experience and interpretations must be provided which promise to bring this change about most effectively.

Industrial-arts work is justified as a means of bringing about these desired changes in the individual because it provides experiences which offer a more effective and more economical means of developing certain desirable objectives which are given as aims of general education. The shop is usually looked upon as a place for making things rather than a place for learning things. The shop and shopwork should be regarded as an interesting, effective, and economical means of attaining a number of objectives that assist in the development and growth of the student as a whole.

The development of skills, use of tools, and the making of beautiful objects should not obscure the opportunity for developing other desirable habits. The achievement of objectives must be made a definite part of the teaching plan and not be neglected. Since woodworking is a tool for learning, it is necessary to provide experiences to develop desirable ideals, attitudes, and habits. Interesting tasks should be arranged so as to require exercises of the qualities to be developed. Experiences in woodwork are designed primarily to develop the ability to plan constructively, involve reasoning and the use of tools. Interest in these activities may be used as a means of developing the objectives of education. To create these situations, no shop teacher can escape organizing his work on the basis of some plan of "fundamental learning."

Industrial arts is one of those arts of handcraft which uses reflective thought and reasoning, the use of tools for construction, serves ordinary needs, and is included as significant in general education. This field is inseparable from valid general education and is an integral part of it. Woodworking is one phase of industrial arts and concerns itself with the broad field which it envelops. The learning is not only through reading, lecture, discussion, and demonstration, but also through a certain amount of actual experiences with tools, machines, materials, procedures, and processes used in industry.

General educative growth is the major objective of woodworking and through this subject one should increase his capacity to understand the social and physical environments, to appreciate them, and to behave intelligently in them. Reflective thought and reasoning and the use of tools are activities of man, which aid him in making his life more agreeable and comfortable. Too often *creative doing* is neglected or inadequately presented through formal education. There is a failure to properly provide for the development of the individual's ability *to plan and do* through industrial activities of the school. When industrial arts is presented, the primary objective should be to present a sequence of experiences out of which will emerge concepts, skills, ideals, attitudes, and appreciations which contribute to general educative growth. Woodworking can easily permit this growth to take place if presented properly. It should take the form of prevocational or exploratory courses. The knowledges learned should be those that may be used in daily living. Skills should be stressed but not at the specialist's level. The whole object that is being constructed should be considered and its parts in detail, only as to their contribution to completing the whole. Too often in school shops, the work done is of two types. One difficulty is when construction of fine pieces of furniture is going on, involving complex and skillful processes which are far beyond the student's constructive ability. The work is being performed solely for the completion of the object. The second unnecessary type of woodworking is when small pieces of wood are cut into joints and exercises. This type is worthless because it does not contribute toward the completion of an object and the interest factor is not considered. The better method of presenting woodworking is through the unit method which uses the individual's potentialities. The work should be performed as one phase of the activities of the general shop where the student may benefit from the experience of seeing other activities going on.

The teacher must, however, consider certain *concepts and detail topics* that should be presented as fundamental knowledge which is essential to bring about the educative growth desired.

The purpose of this discussion, then, is to present a progressive and analytic list of manipulative processes and related knowledge, as concepts and teaching detail topics involved in the subject, woodworking, for technical high school students.

These teaching detail topics give very definite objectives. They are obvious and specific to both teacher and pupil. They are listed according to necessity, and provide a sequence according to difficulty. They present the criteria for preparation of instructional material. They assist the shop teacher to organize his work on a plan of fundamental learning and form a basis for advanced learning.

Projects

The method used to present these teaching detail topics and concepts is primarily dependent upon the constructive projects that are to be made. The teacher should select objects which contain the fundamental processes or those listed first. The objects should be such that their construction does not require too long a period of time. They should be artistic in design, be useful, and should embody sufficient repetition of processes to fix learning. The list furnishes a basis for the teacher to analyze the object so that he may determine whether it contains the elements he wishes to teach, and to check what learning units are involved. The object that the teacher selects should be dependent upon the locality of the school and the interest and needs of the pupil. This is important to consider because localities vary economically and what might be of interest to one group may be unacceptable to another. For this reason, no attempt is made to list pieces of furniture or other objects that may be made. The task of this decision is left to the instructor himself.

Tools

Teaching a knowledge of tools is not a separate study but one which is closely related to a knowledge of the teaching processes. They are taught as the student is ready to use them in a unit of work. This associates the new learning to purpose and need. A student should be able to identify the tools, know how to spell their names, and how to use them. He should also know the general maintenance of the tool, the precautions in using the tool, and the other essential facts that are necessary for efficient usage.

Materials

The materials used are numerous, as can be seen by examining the list "Related Knowledge." The teacher should present information about the materials that are to be used because this makes for intelligent use. This subject can be made most interesting because it contains the elements of wonderment, surprise, and mystery. It provides an excellent means of integrating the subject of woodworking with other academic subjects, such as science, English, history, mathematics, and geography. The facts concerning the materials may vary, but the student should know how they are produced; how they are used in making a project; from what countries they are obtained; how much they cost; and what part they play in world economics. Shellac is a good example. It is a product of India and the fact that it was scarce during the recent war affected and created a shortage of many necessary products for domestic use. This contemporary fact provides the basis for the integration which is referred to.

New Terms and Spelling Words

New terms and spelling are part of the teaching which results from the units as they are presented. No attempt is made to make a list of these words because they are so numerous and varied that they could well be considered for another article. Their selection bears upon the unit taught; the grade being taught; and the purpose of the given woodworking course. However, as a term or word arises in the lesson which requires special attention, the instructor should explain its meaning and associate it with the material or with a manipulative process. Difficult words should be written on the blackboard and in the pupil's notebook and special attention called to that part which makes it difficult. Again the word *shellac* presents an excellent example. When the word *shellac* is written on the blackboard, the fact that *shellacked* and *shellacking* include a *k* should be emphasized. This word *shellac* may be associated with the word *picnic* to bring about fixed and associated learning.

Basic Essential Processes

This is a list of the various essential processes in the order of their necessity in developing skills in woodworking. They are both primary and simple and are particularly applicable to a short, exploratory course or a fundamental course. It establishes the criteria for this particular venture because it provides the basic tastes upon which a student may base a decision. It will assist him to decide whether woodworking satisfies his interest, ability, and aptitude. If his decision is in favor of woodworking, the experience in this skill will form an excellent foundation upon which he may advance in the study of woodworking.

Outline for Exploratory or Basic Course

Processes	*Teaching units or concepts*
1. Make out bill of material	1. Board measure. Prices of wood. Figuring cost of object made. Per cent of waste in constructing project.
2. Reading a working drawing	2. The purpose of a drawing. Two-view drawing. Three-view drawing. Scale drawing. Geometric figures.
3. Use of the vise	3. The care of the vise. Method of placing stock in vise. Other types of vises and their purposes.
4. Crosscut and ripsaw	4. Identification and characteristics of the two saws. When each is used. Starting the cut. Method of holding saw. Hand stroke. Sawing on a line. Safety precautions.
5. Planing with the jack plane	5. Knowledge of the parts of the plane. Position of hands to hold plane. Hand stroke. Method of applying pressure. Resting plane on side when not in use. Sharpening blade. Adjustment and general care of plane.
6. Measuring with rule	6. An instrument of measure. Position of rule when measuring. Dividing equal spaces. Care in using.
7. Gauging with marking gauge	7. The names of the parts of the gauge. Setting the gauge. How to hold gauge. Placing gauge on board. Care and sharpening spur point. Holding head against working surface.
8. Using the try square	8. The parts of the square. Care in using. Method of holding square. Finding the concave side. Testing for squareness. Use in scoring a line.
9. Scoring with the scoring knife	9. Sharpening point. Holding knife to score and scarf. Safety precautions.
10. Backsawing	10. Identifying backsaw. Type of teeth. Method of holding. Position of saw on work. Type of stroke. Sharpening teeth. Safety precautions.
11. Using bench hook	11. Holding device. Position on bench. Holding piece for gauging. Position of piece for backsawing.
12. Drawing curves with compasses	12. Adjusting compasses. Locating pivot point for curve. Method of holding while scribing curve.
13. Curve sawing with coping or turning saw	13. The use of each saw. How to hold saw. Types of strokes. Method of tightening blades. Replacing blades. Speed of saw. Position of saw in relation to work.
14. Filing curved surfaces	14. Different types of files. Method of holding file. Direction of stroke. Cleaning surfaces. Care of files.
15. Nailing parts together	15. Identifying brads, nails, and common nails. How they are selected for work. Spacing on work. Reinforcing with glue. Selecting proper hammer. Related knowledge.
16. Setting with nail set	16. Purpose of setting nails and brads. Selecting proper nail set. Holding nail set. Amount that brad or nail is set.
17. Use of the bit brace	17. The parts and function of the bit brace. The sweep of the bit brace. The position of the hands. Setting the rachet. Setting bit in chuck. Direction for turning. General care.
18. Boring with auger bit	18. Identifying the bit. How bit is marked for size. Parts of the bit and their purpose. Method of boring hole. Reason for counterboring. How to sharpen bit. How it differs from other bits. General care and precautions.

Processes	*Teaching units or concepts*
19. Boring with gimlet bit for screws	19. Identifying the bit. How bit is marked for size. Method of boring directly through. Method of sharpening. Advantages of this bit.
20. Countersinking a hole	20. Identifying the different types of countersinks. Method of sharpening. Determining depth of cut. Setting countersink in bit brace.
21. Driving screws with screw driver	21. Selecting proper screw driver. Sharpening blade of screw driver.
22. Screwing parts together	22. Selecting proper screw. Soaping screws. Boring for reception of screw. Gluing surfaces for added strength.
23. Sanding surfaces	23. Reason for smooth planing. The grades of paper. Selection of proper grade. Holding devices. Direction of stroke. Sanding flat and curved surfaces.
24. Waxing a finish	24. Knowledge of the product: wax. When advisable to use. Method of applying and rubbing surfaces.
25. Painting	25. Preparing surfaces. Knowledge of paint. Proper selection for job. Varieties available. Applying on object. Thinning paint. Rubbing down surface. Cleaning brush and paint can. Precautions.
26. Simple staining	26. The use of water, oil, and spirit stain. Method of mixing various colors. Applying stain to work. Rubbing stained surfaces. Safety precautions with soaked cloth.
27. Shellacking	27. Preparing surfaces for shellac. Preparing shellac to proper density. Drying characteristics. Type of stroke in applying. Rubbing down surface with sandpaper, steel wool, or pumice stone.
28. Varnishing	28. Variety of varnishes. Room conditions. Preparing object for varnish. Thinning. Rubbing and applying. Care of brush.

Tools for Exploratory or Short Course

This is a list of the tools a student should know how to use. They are directly associated with the processes that he will perform in the basic course. He should know the parts that make up the tool. If the tool is the cutting type, he should be taught to sharpen the blade. The care and respect for the tool, as well as the safety precautions, should be stressed.

1. Auger bit
2. Backsaw
3. Bench hook
4. Bit brace
5. Compasses
6. Coping saw
7. Countersink
8. Crosscut saw
9. Dividers
10. File
11. File card
12. Gimlet bit
13. Hammers
14. Jack plane
15. Marking gauge
16. Nail set
17. Ripsaw
18. Rule
19. Screw driver
20. Scoring knife
21. Scrapers
22. Try square
23. Turning saw
24. Vise

Advanced or Occupational Course

A boy who has had a basic understanding of woodwork may decide to continue the study. He may have discovered his interests; his ability warrants further study; or he has a marked aptitude for this type of work. The exploratory course has formed a basis for further development. For this reason a further criteria is developed. The new processes serve as guides for study of the woodworking occupations. They form the background to meet the need of the boy who chooses to work as a woodworker.

Outline of Advanced Processes

Processes	*Teaching units or concepts*
1. Use of planes: *a*) Smooth *b*) Fore *c*) Jointer	1. Characteristics of each plane. The parts of each and their function. Purpose for which each is used. Method of holding each. Types of strokes. Variety of sizes and reason. Grinding and shape of each blade. Care in handling.
2. Planing end grain with block plane	2. Characteristics of this plane. Angle of blade. Method of adjusting. Holding plane. Types of strokes on end grain. Other uses.
3. Using the spokeshave	3. Purpose of this tool. How to hold. Method of stroke. Set of blade. Method of following grain. Crossgrain cutting.
4. Cutting with chisels and gauges	4. Purposes of these tools. Variety of sizes. Method of sharpening. Position of hands in using. Caution about cutting grain. Using mallet for added pressure. Safety precautions.
5. Freehand gauging	5. Position of fingers and pencil. Middle finger against smooth face. Direction of stroke.
6. Boring with Forstner bit	6. Characteristics of bit. Method of marking sizes. Advantages over other bits. Method of sharpening. Boring through hole.
7. Boring with expansive bit	7. Purpose of this bit. Method of setting to desired diameter. Starting the cut. Caution used to prevent splitting stock. Advantages in using as boring tool.
8. Using depth gauge for boring	8. Method of applying and fastening gauge to bit. Reason for use of this tool. Measuring set of gauge to determine depth of cut.
9. Use of dowel jig to determine the location of holes	9. Identifying this tool. Purpose for using this tool. Preparing stock for this tool. Fastening jig on stock.
10. Using mallet	10. Advantages of mallet on some types of work. Reason for use on wood handled tools. Care in handling this tool.
11. Using the bevel for special angles	11. Using the protractor to determine angles. How to set and make bevel fast. Care in using and method of holding bevel against work.
12. Making templets and use on project	12. Method of transferring desired shape to piece for templet. Reason for templets. Advantages of using templets.
13. Boring holes with hand drill	13. Advantages of hand drill for certain types of work. Method of setting drill in chuck. Method of holding drill. Selection of drills for cutting holes.
14. Cutting holes with brad awl	14. Used to start holes for brads and nails. Speed in performing function. Method of starting cut across grain.
15. Clamping pieces with hand screws and clamps	15. Selecting proper hand screw or clamp to particular type of work. Different types of clamps and hand screws. Proper method of adjusting. Protection of work from pressure of hand screws and clamps.

Processes	*Teaching units or concepts*
16. Cutting with miter box	16. Placing stock in miter box. Type of saw used. Method of adjustment for different angles. Use in squaring end. Cutting miter joint. Advantages of miter box.
17. Staining with oil, water, and spirit stain	17. How to mix the different types of stains. When each is used and advantages of each for particular work. Variety of colors. How to apply. Wiping the surface. Care and dangers of used cloth.
18. Fuming and acid staining	18. Types of wood that take this type of staining. Method of applying. Danger of burns and gases. Reason for using this type of stain.
19. Filling pores of wood	19. Reason for using filler. Types and variety of fillers. Mixing colors with filler. Applying on object. Rubbing off and polishing across grain. Care of the used cloth.
20. French polishing with shellac base	20. Advantages of this finish. Preparing pad for polishing. Materials used. Proportions of shellac, alcohol, and linseed oil. Direction of stroke in building finish.
21. Joints: *a*) Butt *b*) Screw and nail *c*) Lap *d*) Miter *e*) Rabbet *f*) Dowel *g*) Mortise and tenon *h*) Dovetail	21. Identifying each type of joint. Understanding when to apply the proper joint to particular work. Know how to lay out end joint. Best method of cutting joint. Proper method of gluing and clamping each joint. Finishing each joint for project.
22. Special planes for variety of cuts: *a*) Rabbet *b*) Groove and tongue *c*) Router *d*) Molding	22. Identifying each plane. How blades are sharpened and maintained. How each is set for cutting. Knowing the different gauges and guards. Methods of moving planes upon wood. Reason for use of each type.
23. Setting a variety of hardware *a*) Hinges *b*) Locks *c*) Drawer pulls *d*) Ball catches	23. Understanding the various types of hardware, and selecting the proper style to meet the need. Proper way to prepare stock. Method of cutting to fit hardware, etc.
24. Simple inlays	24. How they are manufactured. Cutting and fitting into project. Making simple types of inlay. Designing simple inlays.

Tools Used in Advanced Processes

These tools are what are used in the performance of the advanced processes and teaching units. They are listed for the intention that the instructor and the pupil may know what tools are essential for the proper completion of the teaching and learning tasks. A thorough knowledge of the care, sharpening, maintenance, and precautions of each is essential for the proper background.

Auger bit	Block plane	Clamps
Backsaw	Burnisher	Combination square
Bench hook	Carving tools	Compasses
Bevel	Center bit	Coping saw
Bit brace	Chisels	Countersink
Bit gauge	Chipping knife	Crosscut saw
Dividers	Hammer	Pliers
Dovetail saw	Hand screw	Protractor
Dowel jig	Jack plane	Rabbet plane
Drill bits	Jointer plane	Ripsaw
File	Keyhole saw	Rule
Fore plane	Mallet	Scoring knife
Fostner bit	Marking gauges	Screw driver
Framing square	Moulding plane	Spokeshave
Fret saw	Nail set	Try square
Gauges	Oilstones	Turning saw
Gimlet bit	Paring knife	

Woodworking machines are dangerous and extreme caution should be taken when teaching the boys to use them. The danger always remains and even when the pupil has become efficient in using them, safety should be always paramount.

The machines are listed and the various tasks that they perform are included in the teaching units. Only pupils intending to study for the occupation of woodworking should be permitted to use these machines. The teaching units contain the processes that are to be taught.

Machine Work

Processes	*Working units or concepts*
1. Machine sawing: *a*) Ripping *b*) Cutting off *c*) Dado *d*) Angle cutting *e*) Rabbeting	1. Setting up saw. Oiling. Identifying crosscut, rip, combination, and other types of saws. Care of motor. Adjusting height of saw for safety cutting. Setting measures. Adjusting fence to desired width. Setting saw to depth cutting. Cutting pieces to length. Method of adjusting cutting off fence for angle cutting.
Use of push sticks	Cleaning machine. Care in keeping waste off table. Method of starting saw and stopping saw. Safeguards. Use of special jigs for repeated operation. Sharpening different types of blades. Gumming and setting. Other general information. Changing blades.
2. Buzz planing *a*) Edge planing *b*) Beveling *c*) Surface planing	2. Oiling the plane. Cleaning table of plane. Starting and stopping machine. Adjusting guides for cutting. Setting tables for depths of cuts. Safety devices. Replacing blades. Sharpening and whetting blades. Replacing blades. Use of push stick. Precautions in use.
3. Band-sawing	3. Characteristics of the parts of the band saw. Putting on and taking off saw blades. Method of looping belt. Filing and setting belt. Brazing broken saw blades. Care of motor and belt. Setting back guard for depth of cut. Starting and stopping machine. Adjusting tension of saw belt. Setting table for angle cuts. Use of jigs for repeated operation. Use of push stick. Use of cutting off fence and ripping fence.
4. Turning with lathe	4. Identifying turning tools. Specified conditions when each is used. How each is sharpened and honed. Centering stock. Using chucks, faceplate, and other holding devices. Setting calipers and use for measuring on work. Use of dividers and method of setting. Adjustment of speeds. Cleaning and oiling machine. Method of stopping and

Processes	*Working units or concepts*
	starting machine. Identifying, adjusting, and purpose of parts of lathe. Simple straight turning, faceplate turning, and chuck turning. Boring holes with lathe. Safety devices.
5. Boring with power machine	5. Starting machine and stopping. Placing chuck in spindle. Setting stop for depth cutting. Placing bit in chuck. Adjusting table. Oiling machine. Adjustment of guards. Use of jigs. Using drill as router. Use in cutting out mortise. Sharpening the different bits and cutters. Using boring machine as a shaper. Care and maintenance.
6. Cutting stock to thickness with thickness planer	6. Setting plane to desired thicknesses. Knowledge of parts and their functions. Starting and stopping machine. Care of the moving parts. Cleaning table. Adjusting rollers. Sharpening blades and whetting them. Setting blades in revolving head. Safety precautions.
7. Sharpening tools with grindstone	7. Grades of stones and the use of each for particular work. Setting angle guards for different work. Precautions against burning blade. Starting and stopping motor. Oiling. Safety guards. Shaping stones, etc.

List of Related Knowledge

Materials that the boy should be able to identify by name, know how to use, and know enough about each to apply them directly to a specific need. The pupils should know the general cost of each, how to order them, and how to modify them.

Subject	*Information*
1. Wood: lumbering	1. Selection of wood appropriate to project. Biological knowledge of the wood. How it is cut, milled, dried, and delivered to market. Stacking in lumber loft. Identifying the different kinds of wood. Milling and junking boards. Meaning of P2s and P4s. Other information.
2. Glue: *a*) Cold style *b*) Hot style *c*) Casein	2. The history of each type of glue. Source from which each comes. How prepared for market. Average price of each for particular usage. Preparations of stock to receive glue. Preparing glue for using to best advantage. Wise storage of each. Method of applying. Length of drying time needed for each.
3. Nails: *a*) Brads *b*) Finish nails *c*) Common nails *d*) Cut nails *e*) Flooring nails	3. Identifying each type. Method that each uses to indicate size. How they are manufactured. The materials used to make them. Advantages of each. Proper selection for desired job. Method of applying and drawing. Preparing stock for reception of each type. Care of each. Storing. General cost of each.
4. Screws: *a*) Roundhead *b*) Flathead *c*) Ovalhead *d*) Novel head	4. Identifying the different types of screws. How each is measured. Method of selling and general cost. How they are manufactured. Variety of metals used. Preparing stock for each type of screw. How they are applied. Necessity of lubrication. Care and selection of correct screw driver. Advantages of each type.
5. Shellac: *a*) White *b*) Orange *c*) Stick	5. Source of shellac. Biological understanding. Method of manufacture. How it is sold commercially. General price to consumer. General use. Preparation for use. Thinning and liquid used for this purpose. Type of container best for shellac in class usage. Type of brush needed for best results. How it is applied. Length of time needed for drying. Rubbing down shellac surface. Advantages of each type. Condition of room for best results in applying shellac. General use of stick shellac. Applying with aid of alcohol lamp.
6. Varnish: *a*) Floor *b*) Spar *c*) Quick setting	6. Biological and geographic source of varnish. How varnish is manufactured. General price and method of selling. Preparing surfaces to receive varnish. How it is applied. Liquid used to thin varnish. General advantages and disadvantages. Room conditions when using varnish. Care of varnish brush. Methods of rubbing varnished surfaces.
7. Paint: *a*) Flat *b*) Semigloss *c*) Enamel	7. Source of materials for the making of paint. The variety of materials used. How paint is manufactured. Meaning of pigments, vehicle, and dryer. Selection and variety of colors. Advantages of each type. How to thin. Method of applying. Market cost of each. How to mix and change colors. Selection of proper brush. How to apply. Time needed for each type to dry. Room conditions best suited for applying paint.
8. Wax: *a*) Paste *b*) Liquid	8. Materials and knowledge related to the manufacture of wax. Qualities and advantages. Method of applying. Polishing surfaces. When to use wax. Preparation of surfaces for wax.
9. Turpentine	9. Source of materials for manufacture of turpentine. Use as a vehicle and thinner. Characteristic and variety of use. Safety precautions.
10. Linseed oil	10. Materials from which linseed oil is made. How prepared for market and average cost. Various uses of linseed oil. How applied as finish. Drying qualities.
11. Alcohol	11. Materials from which alcohol is made. How prepared for market and average cost. Various uses. How applied as finish. Drying qualities.
12. Pumice and rottenstone	12. History of pumice and rottenstone and geographic source. Number of uses of these materials. How used to rub down surfaces. How sold.
13. Dowels	13. Uses of dowels. Types of wood used as dowels. How they are cut. Various common sizes. Preparations for different uses.
14. Brushes	14. Materials used and method of manufacture. Various types. How they are sized. Selection for various uses. Care while using. Method of cleaning and drying. Cost of each type.

Subject	*Information*
15. Steel wool	15. Used as a finishing material. Advantages and disadvantages. How it is made and graded. Precaution in using.
16. Abrasives: *a*) Garnet *b*) Flint *c*) Waterproof	16. Meaning of abrasives. Materials used to make sandpaper. How they are made. Method of grading to size. Advantages of each type and conditions when each is used. Method of cutting, and how abrasive is held on work.
17. Cloth and waste	17. Economy in usage. Care of oily cloth and waste. When to use to advantage.
18. Stain: *a*) Water *b*) Spirit *c*) Oil *d*) Acid	18. Materials used to make each. Identifying each type. Advantages of each and condition controlling their use. Method of coloring, mixing, and thinning. How each is applied. Method of wiping and rubbing surface. Drying qualities of each. How they are applied. Precautions of wet cloths. Storing.
19. Wood filler: *a*) Prepared *b*) Silex *c*) Colored	19. Use of wood filler. Materials used to make filler. Liquids used. How to prepare and color. Method of applying. Rubbing the surface worked. Time allowed for drying. Care of brush used. Safety precautions.
20. Crack filler and putty	20. Preparation of each. When to use. Advantages and disadvantages. How to apply. Time allowed to dry. Final finish. Kneading to soften. Liquid added.
21. Hardware: *a*) Hinges *b*) Locks *c*) Drawer pulls, etc.	21. Knowledge of commercial varieties. Proper selection for different needs. How they are sized and sold. Preparation of stock to receive various types of hardware. How to order.

Vocational Education and Society

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(*Continued from page 323 of the October, 1947, issue.*)

Expanding the Department

Determination of when departmental work should be expanded:

Occasions arise when the director must decide whether or not one of his departments should be expanded. When this question comes up for consideration the director must make his decision on the basis of fact rather than merely on the basis of his special interest or as the result of a desire merely to enlarge the scope of his work.

When the decision has been made to expand a department or to add a new one it becomes necessary for the director to justify the change to his superintendent. The superintendent is the one who must present the matter to the board; consequently, he must be convinced that the matter he is presenting will bring to the community sufficient additional service to warrant the extra expenditure.

1. *Is the change based upon community needs?*

The superintendent will want to know the extent to which the director has discovered the need in the community for the type of work which he proposes to introduce.

2. *How does the director discover what the needs of his community are?*

It is probable that a survey of the community has been made. The inquiry would attempt to reveal the common occupational fields represented in the area concerned; the extent to which these are growing or diminishing; the number of new people employed in them each year; the grades at which young people leave school; the types of work into which they go, and so forth; any information about the youth or jobs which the director feels will be helpful to him in determining the types of work into which the young people go, and what he can do in his department to help them in their adjustment.

3. *Are the changes based upon the educational needs of the community?*

The director believes that the subjects represented in his department make a contribution to the educational needs of the youth. Since this is true one of the questions the director must ask himself is, "Will the changes contemplated increase this contribution?" and, "In what way will the additional contribution manifest itself?"

4. *Has the director assured himself that the administration has complete and accurate knowledge of what is proposed?*

5. *Has the community been informed?*

It is usually a good policy to make changes only when those who are affected by them are ready to accept them. Some people resent change so they must be informed of impending changes in order that they may adjust their thinking to them before they are imposed.

This suggests that the director may find it advisable to test his ideas by placing them before the administrative group, and in some cases before the public, in a tentative form in order to observe the reactions as well as to benefit from such suggestions as might be given. When this is done such a presentation should include any evidence in the possession of the director which might convey to those interested a better understanding of the proposals.

6. *Is there any evidence that the demand for a new course or class is sufficient to justify it?*

Has an effort been made to develop interest in it on the part of the students? Have they shown eagerness to have the changes made? Is the director sure that the principal approves the new work and has he a definite plan for scheduling it?

7. *Is there a teacher available who can teach the new course you propose to introduce?*

If the director proposes to hire a new teacher he must have information which assures him that he can find one if the proposed expansion is approved by the board. On the other hand, if he hopes to use one of his present teachers he must be prepared with a plan by which his present staff can be reshuffled.

What has been said about increasing the work of the department applies in a general way to any major changes the director wishes to make. Does he wish to reduce the amount of work offered in any school or class? Does he wish to transfer a teacher from one department to another, or from one school to another? It always is desir-

able to prepare the way for any change by preparing those who are affected by it, by giving them an opportunity to learn the reasons for it and to adjust their thinking to it.

The director who has just been appointed should be especially careful in making changes in the situation as he finds it in his new job. It is always a safe plan to assume that your predecessor was a good man and had a good organization that is working well. Starting with this assumption, the director observes what is happening in his department during his first few months in his new position. Undoubtedly, he will find places where he believes changes should be made. These changes should be made so gradually that no one is disturbed unnecessarily. In other words, the new director is most successful when he can change his organization from what he found to what he would like to have without the personnel being aware that change is taking place.

Industrial-Arts Guidance

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The teaching of industrial arts and mechanical drafting subjects is one of the greatest vocations in the world. The writer has just started the twenty-sixth year as a teacher and supervisor, and feels today as he did in September, 1920, that he chose the right profession.

The feature of teaching that has always impressed him most is that of being of *service to others*. The majority of his students have been boys from "the other side of the railroad tracks," sons of recent immigrants to the United States — boys with small chance or thought of ever entering college.

The shop teacher, due to individual instruction and daily contact with his group, occupies a pre-eminent position in a senior high school faculty. As a guidance factor, his influence can be directed toward orienting a student into a sphere or niche in life that will make him a satisfied and useful citizen in the years to come.

In 1936, one of my industrial-arts boys expressed a desire to me to become a shop teacher. He was graduated from Oswego a few years later, and has been teaching industrial arts in West Virginia ever since. He is an excellent teacher and is now happily married.

The writer has been "plugging" for industrial-arts teacher talent since his experience with that boy. In the past several years it has been his custom to arrange an industrial arts and mechanical drafting guidance display on a bulletin board, on the first floor of the school adjacent to the superintendent's office. The contents of facts, photos, and pertinent guidance matters is changed each Monday morning. This display is made as interesting and attractive as possible.

Pertinent guidance topics are assigned weekly in the senior high shop classes for one entire semester. A neat notebook is assimilated by the student and graded by the instructor twice during the term. Definite results are as follows:

Today three of our former industrial-arts graduates are training to be shop teachers at Oswego Teachers College, Oswego, N. Y. One of these young men was a lieutenant, a navigator, in the recent war. He is a junior this year. He and another young man rated in the upper 20 per cent when school ended in June, 1945. The other boy, a colored youth, is doing well in his schoolwork and is one of the most popular fellows at the college.

Five boys, graduates and former industrial-arts pupils, enrolled at Oswego recently, before going into the armed forces. Two of these will be discharged very soon and according to recent letters, will soon matriculate at Oswego.

A few years hence these young men will be out teaching industrial arts and mechanical drafting, perhaps influencing their students to embark upon a life in which they can give "service to others."

Industrial Arts and Vocational Education
John J. Metz, Editor

LUBRICATION — IMPORTANT

It is hardly necessary to tell a shop instructor that it is important for him to see that his machinery is properly lubricated from time to time. In most instances, instructors see that this is done regularly.

Something that is not stressed, however, is that the students are given instruction on lubricating oils and greases which will help them decide what kind of lubricant to use on machines and appliances that are used at home. The number of these home gadgets is increasing from year to year. It would be difficult to evaluate the monetary loss accumulating annually because many of these pieces of equipment are seldom or never lubricated.

Then there is the damage done by well-intentioned people who think anything that is called *oil* will lubricate. How often are kerosene, linseed oil, and other similar oils used to lubricate sewing machines, small motors, and the like. A little time spent on making the student lubrication wise will prevent heavy oils being used where the lightest oil should be applied, or grease substituted in the place of oil on light shafts revolving at high speeds.

Lubricating oils and greases are a bit of related subjects material that should not be overlooked. And while we are considering oils and greases, emphasize the fact that they may be a great fire hazard unless they are most carefully stored in fireproof cabinets.

MAN OVERCOMING NATURE

In 1776 hardy pioneers dug iron ore out of mines in the Adirondack Mountains in upper New York State, and out of it smelted the iron which was then made into the guns and cannon balls that were used during our country's first naval engagement on Lake Champlain.

For many years after, these iron deposits were not molested because nature had surrounded them with defenses which baffled those who tried to open up these rich ore deposits. Not only is it difficult to reach the deposits because of the hard rock formation, but even where the ore vein reaches the surface, the huge snow drifts and the bitter winter cold, often as low as forty degrees below zero, kept man from trying to mine this rich ore. But when World War II conclusively showed that what this country needed was not a five-cent cigar, but tons and tons of steel to make sure the ultimate victory of the allies, engineers seriously attacked the problem of how to wrest this valuable ore from the earth, and found the right answer.

As a result of shrewd engineering that mine is now furnishing the steel industry with about 35,000 tons of iron ore each month. The men who won this victory over nature may or may not have had much cultural education. What they did have, however, was the right amount of know-how and dogged determination to stick to their tasks until they could make the rugged mountains give up their riches, no matter how the weather was. The matter of man power was solved by giving vocational training to the mountainboys and men who lived in the near-by villages, and who knew nothing about mining.

This is just another case where vocational education showed its value, and we, who are interested in industrial arts and vocational training, may be justly proud of the value of our work in this age when men must be able to do as well as to know why and how.

FIRE LOSSES

In an October editorial attention was called to the observance of Fire Prevention Week, October 5 to 11. It is to be hoped that your students profited from this custom of calling their attention to our frightful annual fire losses at least once a year.

It would be well, however, to do a little follow-up work and find out just what the students have learned from the observance of Fire Prevention Week.

And what have you done about it yourself?

Wouldn't it be a good time now to give the school building, especially the shop, a thorough inspection to see that everything imaginable has been done to remove fire hazards.

Fire losses have increased to such an extent that the country is figuring them in hundreds of million dollars per year. The replacement value naturally has skyrocketed, and owners, whether they be private citizens or municipalities, find that they are underinsured when a fire has wrecked their property.

All of this is a warning that fires must be guarded against with greater care than ever. Some of our school shops store and use a great deal of flammable material. Much of it is not even stored in metal cabinets or containers. Have you made a survey of your shop to see what you can do to lessen the fire risks?

It would be time well spent to make this necessary study of existing shop conditions in your school right now. The fire loss to your school building would be bad enough — but what about the loss of life which a fire in your school shop might entail.

And in this survey which it is hoped you are going to make, do not let the fire extinguishers on the wall mislead you. Check them carefully, too. Some of them may be empty. Others may have valves that are corroded or plugged. Put them in condition so they can be used effectively when the need arises. Be sure that both you and the students know how to operate them; otherwise they may not be of much avail when a fire has gained some headway.

Check also whether you have sufficient extinguishers for the size of shop they are to serve. It is better to have too many, rather than not enough when the time comes to use them.

DISCIPLINE

The blame for many of the disciplinary troubles in the school shop must be frequetly placed on the instructor's own shoulders.

To avoid such troubles see that the student has no excuse for loafing or getting into the habit of loafing. When he gets into your class, there must be no question in his mind as to what is expected of him. He must know what his job is, how it is to be done, and where he can get tools, materials, and information whenever he needs them.

The room with its appointments must impress him that it has been equipped and arranged so that work can be carried on efficiently. There must be a place for everything and everything must be in its place.

By observing these rather simple directions the alert teacher will find that disciplinary problems will decrease if not disappear entirely.

Problems in Supervision and How to Meet Them

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(Continued from page 315 of the October, 1947, issue)

Personal Qualities of Supervisors

There is a marked similarity between the qualities of personal leadership in vocational education and those essential to success in industry.

Craig and Charters' Study of Industrial Executives.[6] Craig and Charters interviewed over one hundred highly successful industrial executives to determine the qualities essential to leadership in industry. With these qualities as a basis a training program in personal qualities was proposed. These qualities were found to be:

Forcefulness
Ability to inspire confidence
Ability to take a personal interest in the men
Ability to get the work done correctly
Ability to get and use the ideas of the men
Ability to be one of the men
Ability to lead rather than boss the men
Ability to develop teamwork
Ability to show kindliness without being considered easy
Ability to reprimand properly
Ability to keep from worrying
Ability to delegate work properly
Ability to call forth the best efforts of the men
Ability to train men on the job
Ability to make a new man feel at home
Self-confidence

While not all of these qualities are applicable to vocational education supervisors in the same degree as they are to supervisors in industry, the similarity is striking. The interesting thing about this study is the encouragement given to executives in their attempts to improve weak points.

Personal Qualities of Good Vs. Poor Supervisors. What personal qualities differentiate the good supervisor from a poor one?

One vocational education supervisor sends a list of 25 personal qualities of the good supervisor:

He must be interested in his work.
He must answer all questions; side-step no issues.
He must avoid sarcasm and ridicule.
He must control his temper.
He must be a good sport.
The good supervisor must command the respect of his teachers.
He will have to refrain from being too familiar with his teachers.
He must not ever embarrass his teachers.
He must compliment his teachers on good work.
He must have a good professional attitude.
He must refrain from spreading confidential information given to him by his teachers.
He must be loyal to his superintendent and to the board of education.
He must never use profane language before his teachers.
He must refrain from securing favors for himself at the expense of his teachers.
He must refrain from making uncomplimentary remarks to others about his teachers.
A good supervisor will measure his success by his present ability and not his past performance.
He must be honest.
He must be self-reliant and show considerable initiative.
He must be enthusiastic about his work.
He must be resourceful.
He must be tactful.
He must be sincere.
He must be physically and mentally fit.
He must be punctual.
He must present a good personal appearance at all times.

Others say: "He gets along well with people," and "he understands human nature."

Getting Along With the Soured, Grouchy Teacher. How do you get along with the soured, complaining, chronically grouchy teacher?

One person comments hopefully: "Possible to change even though such characteristics have been acquired over a period of several years."

Others say: "Tell him how he can improve." "We don't get along with him; *he* either changes or 'he changes his job.'"

Retaining Loyalty After a Reprimand. How do you retain the loyalty of instructors who need to be reprimanded?

"Tell him the primary duty of a supervisor is to help the teachers. Remarks and suggestions are made only for this purpose."

"By being considerate; getting all the facts; by being honest and frank with them. Convince them your decision is fair, but be sure it is."

State and Federal Supervision

The discussion by local supervisors of the effects of the state and federal supervision on local supervision gives an opportunity for expressions both commendatory and adversely critical. The paucity of reference by local supervisors to federal supervisors probably reflects their lack of contact with them since they deal largely with state officials. This material is supplemented by a statement from the U. S. Office of Education.

Types of Classes Best Conducted Under State Supervision. What types of trade and industrial classes are more efficiently administered and supervised directly by the state board for vocational education than by local school districts? By the Federal Government? What features of the training program justify direction by these agencies?

"Public service education classes such as fire and police training. Classes for fire bosses and inspectors in mining and training of conference leaders and of supervisors in industry. It is quite possible that a state aeronautical school and other vocational technical types might be desirable because of expense involved."

"Glider construction, because of lack of space in city vocational schools. Lens grinding, because state funds are provided more easily in such cases than local funds."

"None, local districts can offer any classes for which trainees are needed. The state should be concerned with minimum standards for teachers and provision of facilities."

"On the whole we favor district or area administration of vocational classes. One

[6] Craig, David R., and Charters, W. W., *Personal Leadership in Industry* (New York: McGraw-Hill Book Co., 1925), 245 pp. Reference by permission of publishers.

reason is that they are subject to supervision by state officials whereas with state schools the state supervisor may have difficulty for a number of reasons in maintaining a high standard of instruction."

Best Aspects of State Supervision. What aspects of state supervision have you found to be of service to you in your york?

"Publication of excellent monographs, outlines, blueprints, and other teaching aids."

"Dissemination of 'best' methods and procedures in teaching."

"Control of funds."

"Tends to strengthen weak programs, has little effect on strong ones."

"Gives help in locating equipment and materials."

"Freedom from local school politics and extraneous local issues."

"Can frequently see the needs of the community (by contrast) better than local officials."

Annoying Aspects of State Supervision. What aspects have you found to be annoying and, from your point of view, unnecessary?

"Insistence on 100 per cent production training."

"Course outlines prepared elsewhere and sent to local schools to follow."

"Too high standards set for rebuilt machine tool jobs."

"Delay in approval or disapproval of special equipment (federal as well as state)."

"Monthly placement reports require (seemingly) endless repetition."

Loss of Local Initiative. It is said that local initiative is lost owing to detailed rules and regulations concerning such activities, for instance, as the war-production training. In your judgment is this likely to be a serious matter?

"Local field supervisors and trade advisers prevented loss initiative."

"Little difference between local rules and state rules as far as excessive regulations are concerned — not a serious matter, however."

"On the contrary, many of the rules and regulations have stimulated local initiative."

"Real initiative is never lost. Excessive number of forms and reports has materially reduced time and energy to initiate."

"All local initiative was removed from the war-training program due to the rules and regulations under which we were forced to operate. We should have been allowed more latitude to meet local conditions."

Professional Help From the State and Federal Offices. What professional help, excluding financial details, has the state supervisor assigned to your region given you in your local supervisory task? In what ways have you co-operated with him to your mutual advantage?

The State. A former state official reports professional help from state office as follows:

"State supervisors visit and stimulate our teachers professionally through personal conferences in which they give suggestions concerning teaching methods, use of materials and machines, and organization of the shops. They helped to organize our county professional-social group which meets periodically for professional discussion."

"They stimulate teachers to join state and federal professional associations and attend their conventions and regional schoolmen's meetings. They promote and conduct curriculum service centers for preparation of course materials used in our schools. They prepare and help to put into use bulletins on pertinent subjects which serve to stimulate our teachers."

"They have conducted occupational surveys and assisted us in conducting one locally. They have prepared a state bulletin on this subject."

"They aid in making and maintaining contacts with employers and employees and their associations."

"They visit and give assistance to non-reimbursable schools and classes having or working toward vocational objectives."

"They visit and encourage industrial-arts programs."

"They inspect, in order to maintain minimum standards, the facilities, program, and work of vocational-industrial education classes in conformity with modern safety standards."

"They encourage improvement of teachers in service by promoting teacher training classes and stimulating teachers to attend."

Other centers reported as follows:

"State supervisors are most helpful to state operated training centers — appeared

Young Mariners

This photograph was judged best of all entries in the 1947 National High School Photographic Award contest. It was submitted by J. Michael Conner, student of Loyola High School, Baltimore, Md.

to have preference over locally operated training centers when assignmnt or referral of trainees was made at U.S.E.S."

"Aided by arranging for visits to other centers outside local area."

"It has put at our disposal instructional, administrative, and supervisory data and methods used at other centers."

"Local officials call in state and federal supervisors only in emergency — ignored at other times."

"State supervisors never get any farther down the line than the board office."

"Help from state office has been mostly administrative. Visits are few in number and of short duration. Other than assistance in filling out forms, some aid in interpreting state bulletins and help in obtaining equipment and supplies (administrative largely), they have been of little supervisory assistance."

U. S. Office of Education. Regional conferences of state directors, supervisors, and teacher trainers are held annually. Here reports are given by specialists from U. S. Office of Education. Committees of regional conferees have in the past and will again in the future, carry on studies of supervisory procedures.

Special conferences are held on a regional or national basis dealing with special problems of supervision.

Conference reports are prepared and distributed for above conferences. Reports of the series of conferences on supervision (1942) are available: Misc. 3581 on State and Local Supervision and Teacher Training; Misc. 3657 reports conferences (1943) on state-local co-ordination of supervision; Misc. 3657 Supp. 2 — Gains in Industrial Education (1944 conferences).[7]

[7]Send Requests for any of these materials to Vocational Education Division, U. S. Office of Education, Washington, D. C.

Services to individual states by specialists in fields of supervision, teacher training, and curriculum, and scientific selection of trainees are available. The last named service is being experimentally conducted in selected cities and is not yet available generally.

Instructional materials made possible by States. Instructional monographs in major fields in which war-production training has been given. Misc. 3499 is a catalog listing these and other valuable teaching materials.

A supervisory bulletin is in preparation. Misc. 3081 is an outline of this bulletin.

Specific reference was made to the federal office assistance:

"It has aided in establishing trainee acceptance center for examination of trainees."

"It helped welding course by establishing nationwide standards."

(To be continued)

Planning the Industrial-Arts Shop

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A well-planned shop is a basic necessity for teaching industrial-arts work at any grade level. Size, ventilation, lighting, placement of benches and machines, acoustical treatment of walls and ceiling, and color dynamics are factors which present a continuous challenge to industrial-arts teachers, supervisors, and administrators who are planning new industrial-arts shops or remodeling existing shops which are no longer adequate to house a well-rounded industrial-arts program.

The authors have devoted considerable time and thought to the designing of workable industrial-arts shops at all grade levels during the past twenty years. The five shop plans presented and discussed on the following pages have incorporated in them features and refinements which have proved effective under practical school conditions. While all shops should be planned and equipped to provide the best facilities for teaching the industrial-arts course offered in a given school, it is hoped that these shop plans will prove suggestive but that where necessary they will be modified to meet local school conditions and course content.

Elementary Shop — Grades 4–8

The elementary industrial-arts shop shown in Figure 1, is 60 by 24 ft., and allows 72 sq. ft. per pupil with a class size of 20. The shop has a planning room, toolroom, and finishing room, and is equipped to offer elementary instruction in wood, metal, plastics, textiles, and leather. Lockers are provided inside the shop and in the corridors. Exhibit shelves are provided above the blackboard and corkboard areas. Two doors are provided into the corridors as required by the building codes of some cities. The ceiling may be acoustically treated and the walls and equipment should be finished in colors which are pleasing and which add to the efficiency and safety of the shop. There should be at least 20 foot-candles of light on the working surfaces and if it is necessary to use curtains, Venetian blinds are preferable

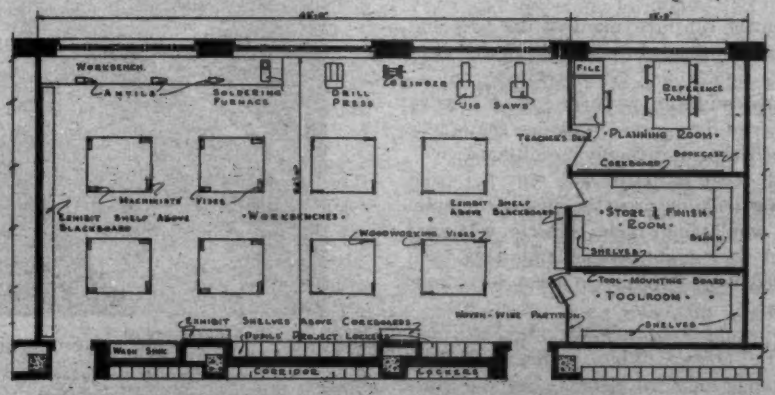

Fig. 1. Elementary shop (Grades 4 to 8)

as sunlight can be reflected to the ceiling and dispersed over the room without producing a blinding glare.

The elementary industrial-arts shop has the following equipment and built-in feature.

Equipment	*Number*
Four pupil woodworking benches (drawers or lockers below)	4
Four pupil metalworking benches (drawers or lockers below)	4
Workbench (or wall bench)	1
Teacher's desk and chair	1
Desk-high filing cabinet	1
Bookcase in planning room	1
Reference table and four chairs	1
Jig saws (floor models)	2
Grinder (floor model)	1
Drill press (floor model)	1
Soldering furnace (bench model)	1
Anvils	3
Machinist's vises	16
Woodworking vises	16
Sections of exhibits shelf above blackboards and corkboards	4
Sections of corkboard	3
Sections of blackboard	2
Wash sink	1
Set of propect lockers (also used for shop aprons)	1
Finish bench in store and finish room	1
Shelving in store and finish room	
Tool mounting board in toolroom	
Shelving in toolroom	1

General Shop — Grades 7–12

The general shop illustrated in Figure 2 is 70 by 30 ft. and allows 105 sq. ft. per pupil for a class of 20 students. The shop is equipped to teach drafting, woodwork, metalwork, auto mechanics, and plastics. This general shop is suitable to house the industrial-arts program in schools which can have only one industrial-arts teacher. The shop has a double door to the outside, two doors into the corridor, glass exhibit case, tool room, visual and planning room with glazed partition, and storage in the shop and in the basement for supplies and projects. The tops of windows should be 15 ft. from the floor if the room is 30 ft. wide, otherwise the height should be one half the width of the shop room.

Equipment	*Number*
Four pupil woodworking benches (drawers or lockers below)	4
Woodworking vises	16
Bench for metalworking	1
Machinist's vises	6
Engine (internal combustion)	1
Engine stand (for internal-combustion engine, engine analyzer)	1
Wall bench	1
Tire testing tank	1
Tungar charger	1
Electric arc welder	1
Set gas welding equipment	1
Welding table	1

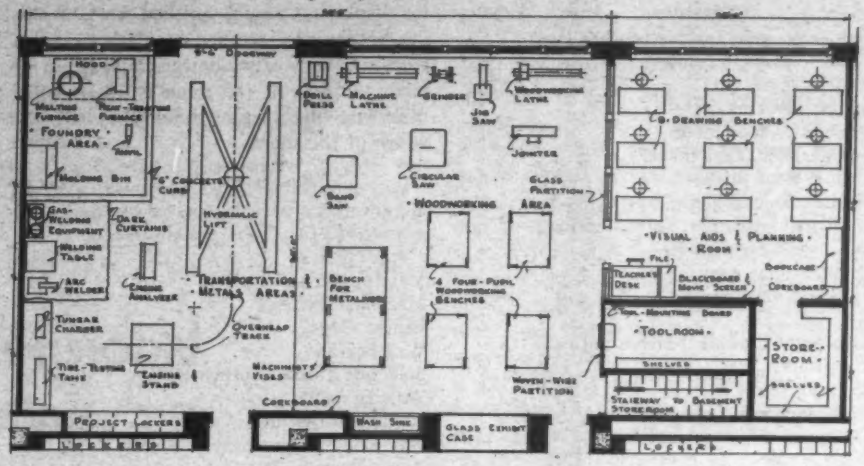

Fig. 2. General shop (Grades 7 to 12)

Equipment	*Number*
Molding bin	1
Heat-treating furnace	1
Anvil and stand	1
Drill press (floor model)	1
Machine lathe (floor model)	1
Grinder (floor model)	1
Jig saw (floor model)	1
Woodworking lathe (floor model)	1
Band saw (floor model)	1
Circular saw	1
Jointer (floor model)	1
One pupil drawing benches (drawers below)	9
Drafting stools	9
Bookcase	1
Teacher's desk and chair	1
Desk-high filing cabinet	1
Movie screen	1
Glass exhibit case	1
Wash sink	1
Corkboard	2
Project lockers (projects and aprons)	1
Dark curtains and pipe supports	1
Concrete curb around foundry area	1
Hood above furnaces	1
Hydraulic lift	1

Equipment	*Number*
Overhead track	1
Blackboard	1
Tool mounting board (toolroom)	1
Shelves (toolroom)	1
Shelves (storeroom)	1

General Woodworking — Grades 7–12

The general woodworking shop illustrated in Figure 3 is 68 by 30 ft. and is suitable for woodworking classes from grades 7–12. The shop provides facilities for teaching hand and machine woodworking. The reference and planning room, finishing room, and toolroom are separated by partitions. A lumber storage room is provided under the shop with connecting stairway. Exhibit case is provided in corridor and lockers are provided in the shop and corridor. This shop has natural lighting from two sides and the power machines are placed to take full advantage of the natural lighting. The tops of windows should be 15 feet from the floor and the ceiling acoustically treated.

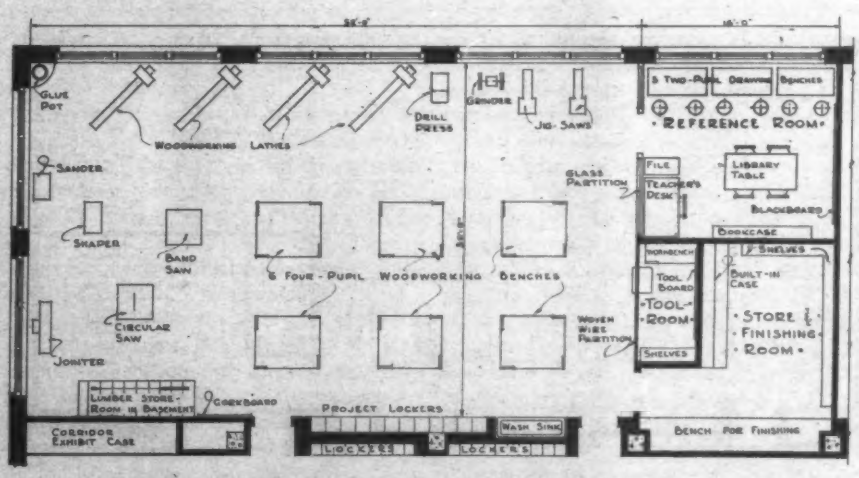

Fig. 3. General woodworking (Grades 7 to 12)

Equipment	*Number*
Four pupil woodworking benches (lockers or drawers below)	6
Woodworking vises	25
Jointer, floor model	1
Band saw, floor model	1
Circular saw, floor model	1
Shaper, floor model	1
Sander, floor model	1
Woodworking lathes, floor model	4
Drill press, floor model	1
Grinder, floor model	1
Jig saws, floor model	2
Gluepot	1
Two pupil drawing benches with drawers	3
Drawing stools	6
Teacher's desk and chair	1
Desk-high filing cabinet	1
Library table	1
Library chairs	4
Bookcase	1
Blackboard	1
Corkboard	1
Wash sink	1
Project lockers for projects, aprons, etc.	1
Gluepot shelf	1
Workbench in toolroom	1
Tool mounting board (in toolroom)	1
Shelves (in toolroom)	1
Case (store and finishing room)	1
Bench for finishing (store and finishing room)	1
Shelving (store and finishing room)	
Corridor exhibit case (glass front)	1

General Metal Shop — Grades 7–12

The general metal shop illustrated in Figure 4 is equipped to handle a class of 24 students and provides instruction in foundry, machine shop, sheet metal, bench metal, and welding. The foundry area is equipped with a hood and has a concrete floor with 6-in. curb. The planning and visual education room, toolroom, and storeroom are separated by partitions. An exhibit case in the corridor provides space for displaying pupils' finished work. Welding booths are screened by dark fireproof curtains. Tops of windows should be 15 ft. from the floor if the room is 30 ft. wide, otherwise the height should be half the width of the room.

Equipment	*Number*
Metalworker's benches (one is to be notched for two metalworker's stake plates)	4
Metalworker stake plates	2
Machinist's vises	22
Bench anvils	2
Wall bench	1
Soldering furnace, bench model	1
Welding tables	2
Electric arc welder	1
Gas welding equipment	1
Anvil, floor model	1
Heat-treating furnace	1
Melting furnace	1
Molding bin	1
Shaper, floor model	1
Milling machine, floor model	1
Drill press, floor model	1
Grinder, floor model	1
Machine lathes, floor models	2
Folder and brake, floor model	1
Squaring shears	1
Revolving standard for sheet-metal working machines	1
Sheet-metal machines, including beader, crimper, edging machine, etc.	1
Two pupil drawing benches with drawers below	7
Drafting stools	14
Teacher's desk and chair	1
Desk-high filing cabinet	1
Bookcase	1
Movie screen	1
Wash sink	1
Lockers, for projects and aprons	2
Corkboard	1
Dark curtains and pipe supports	1
Hood above furnaces	1
Concrete curb around foundry area	1
Blackboard	1
Tool mounting boards, toolroom	3
Case, storeroom	1
Rod and bar rack, storeroom	
Shelving, storeroom	1
Corridor exhibit case, glass front	1

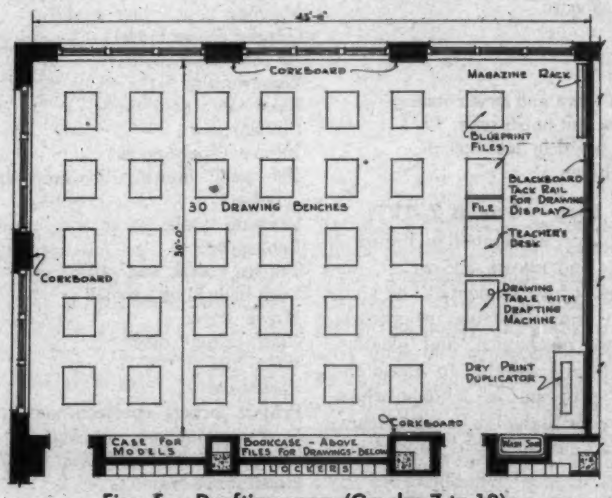

Fig. 5. Drafting room (Grades 7 to 12)

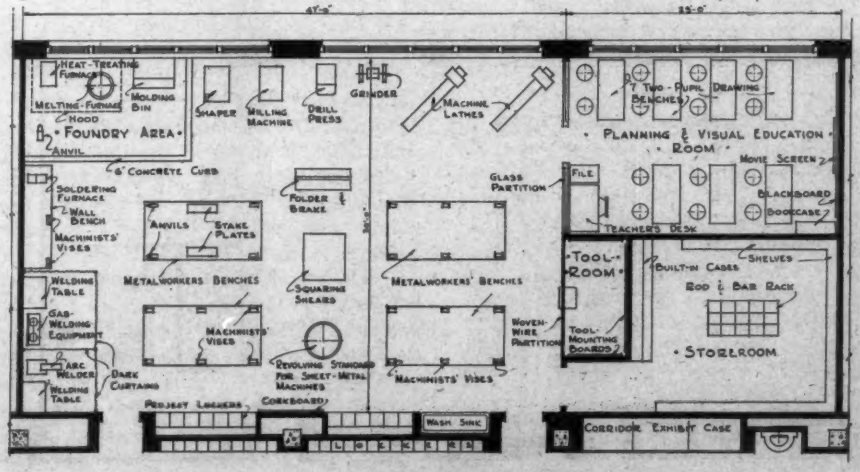

Fig. 4. General metals shop (Grades 7 to 12)

Drafting Room — Grades 7–12

The drafting room illustrated in Figure 5 will accommodate 30 students and has natural lighting from two sides. Venetian blinds should be used if it is necessary to use curtains, and fluorescent lighting is desirable when artificial lighting is needed. Stools may be used with the drafting benches but many teachers prefer to have the students stand. Cases for models and files for drawings are provided.

Drafting Equipment	*Number*
One pupil drawing benches, with drawers for equipment	1
Blueprint files for storing large drawings	2
Desk-high letter file, for teachers	1
Teacher's desk and chair	1

Built-In Equipment	*Number*
Adjustable drawing table with drafting machine attached	1
Dry print duplicator with bench below for storing materials	1
Magazine racks for current magazines and periodicals	1
Small corkboards	4
Large blackboard	1
Wash sink	1
Tack rail above blackboard to display drawings	1
Case for models or machine parts, glass door	1
Case for books in reference library	1
Drawers, below model and bookcase for filing pupils' drawings	2

Using Three-Dimensional Models in Designing

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There is no better way to present a design idea than in the form in which it will finally exist. Because it is seldom practical to do this, the three-dimensional model is of great importance in the field of industrial design, so much so, that many designers maintain their own model shops in which they construct models of proposed designs for their clients. This permits observation of the evolution of the design in three dimensions and provides for improving the design as the work progresses. If this work is well done the model produced will usually be surprisingly close to the design idea in its final form.

The use of the model in conjunction with design has been an accepted fact for hundreds of years. As far back as the sixteenth century the British and French admiralties made use of models in connection with the design and construction of ships. It is also interesting to note that our navy used models to solve many of our naval design problems in the late war. Largely through the use of the model it was possible to put shipbuilding on a mass production basis. This was accomplished by using models to prove and co-ordinate the vast number of blueprints required in shipbuilding. For example, to prevent costly delays during final assembly, models were constructed from assembly blueprints. These models revealed errors that otherwise would not have been discovered until actual construction was under way. The fact this was done was an important factor in our victory over the problem of the mass production of ships.

Without doubt, there is definite need for greater use of the three-dimensional model in the present-day field of industrial design. The present practice is to use a rendering where a model should be used. The rendering presents a beautiful picture, but it only shows one view. Irrespective of how well the rendering is handled it can never be as convincing as the three-dimensional model. The model is actual.

Many designers who do not have model shops have come to realize the important function the model plays in designing and are turning to outside sources, patternmakers, free-lance modelmakers and small shops to have this significant work done. Actually, the model should be made under the eye of the designer. When this practice is followed the designer is in close contact with the actual development of the design, and in position to make any alteration that may improve his work.

In industrial designing the model offers one of its greatest values as an aid to visual study. Through the use of the three-dimensional type model the design may be viewed from all angles, colors may be experimented with and forms altered in the process of evolving the design. The visual model lends itself far better to this type of study than does the ordinary flat rendering or drawing.

The use of the model in industrial designing is not limited to the visual model exclusively. In actual practice the engineering model is used extensively and generally takes the form of an actual working model of the design under consideration. The engineering model will usually roughly indicate the answer to the problem, or it may be developed into a *slicker* job than the finished product. For example, working models of sockets for fluorescent tubes were so well made in an industrial designer's model shop that the client was under the impression the sockets had been cast by the usual plastic molding process.

Everyone is familiar with the appearance of the old-fashioned hand lawn mower. Designers, it seems, are always being called upon to restyle these machines. Good results are always obtained by preliminary planning, followed by the construction of full-sized visual models. A visual model of this type is usually constructed of wood, metal, and perhaps a few plastic materials and finished by spray painting with lacquer. With a full-sized model to work with, the problems of formulating well-designed cowls, good color combinations, improvements on, and refinements of, design, are very easily handled.

For many years the visual model has been used extensively in connection with the designs for radio cabinets. Such models when well constructed so closely resemble the finished product that in many instances it has proved difficult to distinguish between a model and actual set, even at very close range. In addition to proving of great value to the designer, clients are always extremely pleased with a preview of their finished product in the form of a model. To this extent, models also aid the designer in demonstrating the attributes of his design.

In designing for today's markets the many products used manually must also be considered. These must be designed from a *feel* standpoint as well as visual. The housewife will not buy an iron unless the handle is comfortable and the whole design feels right and is properly balanced. Here again the designer finds the model playing a very important part in working out the design. In fact, in developing any design that hinges on *feel* it would be practically impossible to produce a satisfactory result without using a model.

No doubt if more large designs were developed through the use of small models, better full-sized designs would result, provided the sense of feeling was taken into consideration as part of the design in the small model.

Since every design is made to fill a need of one kind or another, all designs may be considered functional in one way or another. The use of the term functional as applied to models may be narrowed to imply a model that demonstrates a working function of the design. For example, a working model of a flashlight, radio console, lipstick case, etc. In industrial designing there is a specific need for this type of model because it is not always practical to work out the problems connected with the mechanical operations of a design on the drafting board. It has been demonstrated time after time that it is much easier to work the *bugs* out of a mechanism when you are dealing with the actual mechanism, be it lipstick or locomo-

tive. This type of model will pay for itself over and over again in all cases where it is used in connection with a product that is to be mass produced. It will also bring to light errors in designs as they affect costs.

One of the most important things the industrial designer is concerned with in designing is cost. By the use of a model the entire picture of cost is brought out into the open and many things that otherwise might be obscured in drawings are easily detected and remedied. This is especially true in cases where the design problem is integrated with an engineering problem. For example, in designing a power lawn mower it was decided the best course to pursue would be to construct an actual working model of the machine. This proved to be of great value to the designer because it not only proved easier to design the machine by building an actual working model, but construction of the model also disclosed certain changes in materials and method of assembly that would considerably reduce certain production costs. Even though the manufacturer had been producing a somewhat similar machine for some time these cost cutting ideas had not occurred to them. Needless to say the client was very pleased with the savings effected. It is also interesting to note that in this particular case the model was constructed largely from rough sketches. When work on the model was completed and everything proved entirely satisfactory, a suitable set of drawings was made for the client. This not only proved to be a very efficient way for the designer to handle the work, but it also resulted in considerable reduction in the cost of producing the design.

Anyone who will reflect for a moment will quickly determine the value of the model in the field of design. The use of the model has proved to be of inestimable value to both designer and client, and the designer who seizes every opportunity to make use of this valuable adjunct will be better able to serve his client as well as lighten his own tasks.

Teaching Materials for Industrial Education

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Teaching Materials for Industrial Education was compiled to assist teachers of industrial arts and vocational education in obtaining the inexpensive or free teaching aids which the manufacturing industry and other agencies in the United States prepare for the benefit of educational groups or interested individuals.

Since many of the booklets, bulletins, charts, and samples have been prepared at considerable cost to the companies who offer them for loan or use, it is but courteous for the person who requests such loans or aid to enclose sufficient postage with the request to cover mailing charges.

Teachers should use school stationery when writing for any of the items listed to expedite reply. All items are free unless otherwise noted. In most cases a small charge is made when free items are ordered in quantities.

This list of inexpensive teaching aids was arranged in the following manner for the convenience of the teacher or person who wishes to find a specific listing under a definite heading:

Bulletins and Booklets
Drafting
Electrical and *Communications*
Handcraft
Industrial and *General*
Metal
Plastics
Transportation
Woods

Charts
Drafting
Electrical and *Communications*
Handcraft
Industrial and *General*
Metal
Plastics
Transportation
Woods

Films
Drafting
Electrical and *Communications*
Handcraft
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Dietzgen Co., Inc., Eugene, 218 East 23rd St., New York 10, N. Y.
Essential Drawing Instruments and Tools
Use and Care of Drawing Instruments with Instructive Exercises

Hunt Pen Co., Howard C., Camden, N. J.
Elementary Alphabets and Their Construction — 15 cents
Pen Tips on Cartooning — 25 cents
Textbook of Lettering Poster Design — 50 cents
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Linoleum Block Printing with Color — 50 cents

Keystone View Co., Meadville, Pa.
How to Make Handmade Lantern Slides — 10 cents

Pittsbugh Plate Glass Co., 632 Duquesne Way, Pittsburgh 22, Pa.
Color Dynamics for Buildings
Pittsburgh Color Dynamics for the Home
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Allied Radio Corp., 833 West Jackson Blvd., Chicago 7, Ill.
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Dictionary of Radio Terms — 15 cents

Radio Formula and Data Book — 10 cents
Radio Circuit Handbook — 25 cents
Radio Data Handbook — 25 cents
Manual of Simplified Radio Servicing — 10 cents
Coil Winding Calculator — 25 cents
Parallel-Resistance and Series-Capacitance Calculator — 25 cents

American Phenolic Corp., Chicago 50, Ill.
Radio and Electronic Parts Catalog No. 72

American Telephone and Telegraph Co., 195 Broadway, New York 7, N. Y.
The Telephone in America
The Magic of Communication

Columbia Broadcasting System, 485 Madison Ave., New York 22, N. Y.
CBS School of the Air Manual, 1947–48 season
CBS Listener's Guide (monthly except summer months)

Columbia University, Bureau of Publications, Teachers College, New York 27, N. Y.
Suggestions for Teaching Selected Material from the Field of Electricity by Robert Stollberg — 75 cents postpaid

Concord Radio Corp., 901 West Jackson Blvd., Chicago 7, Ill.
Radio Training Kits
Complete Radio and Electronic Equipment Catalog No. 447

Dumont, Allen B., Laboratories, Inc., Passaic, N. J.
How the Cathode-Ray Tube Operates

Dumore Co., 14th and Racine Sts., Racine, Wis.
Care and Operation of Portable Precision Lathe Grinders

Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia 32, Pa.
The Storage Battery: Its Fundamentals, Use and Maintenance

Farnsworth Television & Radio Corp., Fort Wayne 1, Ind.
Television: Bringing the World to Your Home

General Electric Co., 1 River Road, Schenectady 5, N. Y.
Applications of Atomic Power
What's New in the World of Science
The Story of Steinmetz
The Story of G-E Research
The Story of the Turbine
A Primer of Electronics
How Electronic Tubes Work
Adventures in Electricity:
1. *The Generation of Electricity*
2. *Uses of Electricity*
3. *Distribution of Electricity*
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Quarterly *News Digest*
General Electric House of Magic
The Story of Lightning
Things I've Been Thinking About
The Romance of Electricity

General Electric Consumers Institute, 1285 Boston Ave., Bridgeport, Conn.
Frozen Foods — 3 cents
Home? (A booket on home wiring) — 10 cents

The Hoover Co., North Canton, Ohio
Notes on Buying and Using an Electric Cleaner
House Cleaning and Home Management Manual
Facts You Need to Know About Moth Control
Carpets and Rugs
Carpet Sample Exhibit (Loaned for one month. Return postage and insurance paid by user.)

Illuminating Engineering Society, 51 Madison Ave., New York 10, N. Y.
Experiments with Light — 25 cents
Home Lighting, Recommended Practice — 25 cents (June, 1945)[1]
Industrial Lighting, American Recommended Practice — 25 cents (May, 1942)
Office Lighting, American Recommended Practice — 25 cents (Sept., 1942)
School Lighting, American Recommended Practice, in revision
Street and Highway Lighting, Recommended Practice — 50 cents (Feb. 1946)
Illuminating Engineering Nomenclature and Photometric Standards A.S.A. 271–1942 — 25 cents (Sept., 1941)
Standard Method for Measuring and Reporting Illumination from Artificial Sources in Building Interiors — 10 cents
Footcandle Survey Form — 1 cent
Industrial Lighting Reports — 15 cents each
Intricate Production, Assembly and Inspection Processes (Dec. 1937)
Power Presses (Feb., 1939)
Shoe Manufacturing Industry (Mar. 1937)
Textile Industry — Grey Goods and Denim (Mar. 1937)
Textile Industry — Silk and Rayon (Jan., 1938)
Standards of Quality and Quantity for Interior Illumination — Committee Reports:
1. *Brightness and Brightness Ratios* (Dec. 1944)
2. *Visibility Levels* (May, 1946)
3. *Interreflection Method of Predetermining Brightness Ratios* (May, 1946)
4. *Brightness Distributions in Rooms* (to be published)

Lighting Performance Recommendations for Portable and Installed Residence Luminaries (July, 1946)
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Experiments with Light, for science students — 25 cents
Chapters on Light, a supplement to physics texts — 25 cents
Lessons in Practical Illumination (outline) — 5 cents multilith copy
Lessons in Practical Home Illumination (outline) — 5 cents multilith copy
Lighting Data Sheets, actual installations with engineering data and illustrations, yearly series (24 sheets in each)
Series 6 to 12 available at $1 per series (6 to 12 inclusive, $5.25)

[1]Indicates date when material was previously published in *Illuminating Engineering*, monthly publication, subs. price, $10 per annum; single copies, $1.50. Not published in August and October.

Handbook of Residential Wiring Design — 25 cents
Handbook of Farmstead Wiring Design — 40 cents

Mallory and Co., Inc., P. R., Indianapolis 6, Ind.
Radio Service Encyclopedia — 5th Edition — $1.50
MYE Technical Manual — $2
Vibrator Data Book — $1

Ohmite Manufacturing Co., 4835 Flournoy St., Chicago 44, Ill.
The Ohmite News — monthly publication

Sciaky Brothers, 4915 West 67th St., Chicago 38, Ill.
Resistance Welding at Work
General Catalog

Shallcross Mfg. Co., Collingdale, Pa.
Shallcross D–C Bridges, Bulletin D-1
Shallcross Akra–Ohm Resistors, Bulletin R-1
Shallcross Electrical Measuring Apparatus

Sylvania Electric Products, Inc., Emporium, Pa.
Radio Instruction Course
Multiplying Pennies
Technical Manual — 85 cents
Radio Symbol Guide — 25 cents
Characteristics Sheet

Ultra Violet Products, Inc., 5205 Santa Monica Blvd., Los Angeles 27, Calif.
Fluorochemistry — 5 cents
Fluorochemistry in Petroleum Science — 5 cents
Ultraviolet Light in Criminology — 5 cents
The Ultraviolet Lamp in Scientific Research — 5 cents
The Ultraviolet Lamp in Education — 5 cents
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Ultraviolet Light in Uranium Prospecting — 5 cents
Luminescence in Gem Science — 5 cents
Fluorochemistry in Dyestuffs and Textile Science — 5 cents
Ultraviolet for the Hobbyist — 5 cents

Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago 11, Ill.
Testing for Safety
You Are Safer Than You Know
List of Inspected Electrical Equipment

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.
Alternating Current Simply Explained

Western Union Telegraph Co., Public Relations Dept., 60 Hudson St., New York 13, N. Y.
The Story of Western Union
Westward to Europe
Telegrams and Cablegrams: Your Business Tools
Chronology of the Telegraph

Westinghouse Electric Corp., School Service, 306 Fourth Ave., Pittsburgh 30, Pa.
Illustrated Catalog of Free and Low-Cost Teaching Aids
Pictorial Bulletins issued once a month
Rural Electrification Series

Adventures in Research — transcriptions of 30 radio programs
Scholarships by Westinghouse
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Westinghouse Little Science Series booklets:
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Science in Everyday Things
Eyes and Ears for the Millions
Amber and Amperes
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Man's Heritage of the Skies
World Within the Atom

Homemaking Materials:
Electric Home Appliances
Modern Home Laundering
Electric Refrigeration and Wartime Health

Student's Folders:
Kitchen Planning and Kitchen Appliances
Laundry Planning, and Vacuum Cleaners

Consumer Booklets:
The Fluorescent Lamp (single copies only)
The Lighter Side of Life

Weston Electrical Instrument Corp., Newark 5, N. J.
Monograph Number 3, on Electricity (single copies to teachers only)

The Wiremold Co., Hartford 10, Conn.
Wiremold Catalog and Wiring Guide No. 17
Another Wiremold Aid to Better Lighting
Wiremold Surface Metal Raceway Wiring Systems
Wiremold Engineering Data Sheet Service:
Plugmold Installations on Work Tables for Small Motors
Infra-Red Oven Installation
Installation of Wiremold No. 3000 and Interconnection with No. 700
Wiremold "3000" Wiring System
No. 1500 Pancake Over-Floor Wiring System for Telephone Installation
No. 2600 Pancake Over-Floor Wiring System for Typical Telephone Installation

Handcraft

American Crayon Co., P.O. Box 581, Sandusky, Ohio
Successful Silk Screen Printing with Prang Tempera
Silk Screen Printing with Prang Textile Colors
Industrial Crayon Guide
Blackboard Bulletin
Prang Powder Tempera Projects
Crayon Projects with Crayonex
Problem and Idea Index of Unit Subjects
Fabric Decoration with Prang Textile Colors
Problem and Idea Portfolio No. 1 and 2 — $1 each
Plasti-Glaze — A hard ceramic like color glaze that needs no firing
Carvocast — *Carving, Casting and Coloring*
Stixit Paste
Prang Drawing Ink
Prang Water Colors

Ansco, Binghamton, N. Y.
Report of a Camera Club Survey
Developing and Printing Made Easy — 25 cents
Ansco Photographic Papers — 15 cents
Ansco Formulas for Photographic Use — 10 cents
Better Photography Made Easy — 25 cents

Argus, Inc., Ann Arbor, Mich.
Good Pictures, Helpful Hints for the Amateur Photographer — 25 cents

Berkley Models, Inc., 140 Greenpoint Ave., Brooklyn 22, N. Y.
1947–48 Model Handbook and Catalog — 25 cents (free to teachers)

Bicycle Institute of America, Inc., 122 East 42nd St., New York, N. Y.
How to Care of Your Bicycle
The Bicycle Mechanics Course — 10 cents
Bicycle Safety League Decalcomania
Membership Card — *Bicycle Safety League*
Cycling Handbook
Attaining Physical Fitness Through Bicycling

Broadhead-Garret Co., 4560 East 71st St., Cleveland 5, Ohio
Broadhead-Garret Company Catalog 1946–1947

Columbian Rope Co., Auburn, N. Y.
Rope Knowledge for Scouts
How Columbian Pure Manila Rope is Made
How to Wrap and Tie Packages
Story of Manila Fibre
Story of Sisal Fibre
Educational Display[2]

Comet Model Airplane and Supply Co., 129 West 29th St., Chicago 16, Ill.
Kit No. G3. Mosquito Glider — 15 cents
No. 21. Phantom Flash (R.O.G.) — 15 cents
No. A2. Zippy — 15 cents
No. A4. Sparrow — 15 cents
No. E12. Firefly (R.O.G.) — 25 cents
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No. AOT. Air-O-Trainer (Aircraft Control Demonstrator) — $1.50
No. G2. Mustang Glider — 35 cents
No. E27. Bluebird — 25 cents
No. L9. Dipper — 50 cents
No. E24. Phantom Fury — 25 cents
No. W1. Sparky — 75 cents
No. P6. Clipper Jr. — $1
No. P7. Pepper — $1
No. Y1. Gull — $1.50
(Above kits are listed in approximate order of complexity and necessary skills.)

Eastman Kodak Co., Rochester, N. Y.
Descriptive Literature on Kodaks
1. *Kodak Filters and Other Lens Attachments*
2. *Kodak Publications*
3. *Kodak Picture-Making Aids*
4. *Kodachrome Adapters*

Kodak Versatol Developer
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Picture Taking at Night
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How to Use Kodak Microdol Developer
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Kodak Filters and Other Lens Attachments
Tips for Better Kodacolor Pictures
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How to Make Good Pictures — $1
Kodak Data Books — 25 to 50 cents
An Elementary Course in Photography
(A wide range of pamphlets dealing with special phases of photography is always available. Individuals requesting materials should indicate their area of interest, and literature pertinent to the subject will be furnished.)

Edwal Laboratories, Inc., 732 Federal St., Chicago 5, Ill.
Modern Developing Methods for Prints and Fine Grain Negatives — 65 cents
Professional Photographer's Manual

Fellowcrafters, Inc., 13 Clarendon St., Boston, 16, Mass.
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Indian Slippers That You Can Make — 20 cents
How You Can Make the Inkle Loom and Weave With It — 20 cents
Finger Weaving — 20 cents
Design and Hook Your Own Rugs — 20 cents
Linoleum Blockprinting — 20 cents
Chip Carving (No. 9956) — 20 cents
Whittling Novelties from Wood — 20 cents
Small Animal Sculpturing — 20 cents
Cutting and Polishing Small Stones — 20 cents
The Cradle or Box Loom — 20 cents
It's Fun To Do Cross-Stitch and Needlepoint — 20 cents
Braided and Interbraided Rugs — 20 cents
Making Duck Decoys — 20 cents
Glove Making — 20 cents
Tooling Leather — 20 cents
Portraits and Landscapes in Fine Veneer Woods — 20 cents
Horncraft — 20 cents
Billfolds and Purses — 20 cents
Brown Book of Traditional European and Polynesian Chip-Carving Designs — $1.50
Orange Book of Designs and Patterns — $1.50
Green Book of Stenciling with Hand-Made Tools — $1.50
The Golden Book of Designs — $1.50
The Blue Book of Designs — $1.50
Glove Patterns — 15 cents
Leathercraft for Beginners — 25 cents

[2]The Educational Display contains all the pamphlets listed above as well as a few additional blotters and folders.

Leathercarving — 35 cents
New Clays for Old Uses — 25 cents
Simplified Scroll Work With the Flexo-Jig — 35 cents
Easiweaving — 15 cents
Metal Tooling — 25 cents
Silk Screen Process Printing — 25 cents
Gimp Braiding Projects — 40 cents
Chip Carving (No. 9950) — 25 cents
Amberolcraft — 25 cents
Metalcraft for Beginners — 25 cents

Fisher Body Craftsman's Guild, General Motors Bldg., Detroit 2, Mich.
Details and Instructions for Designing and Making a Model Automobile — 1948 Manual
Your Boy and His Future

The Handcrafters, Waupun, Wis.
Free information on materials and methods of craft work

Handy and Harmon, 82 Fulton St., New York, N. Y.
Silver for the Craftsman
Making Hand Wrought Sterling Silver Jewelry — $1 (free to teachers)
(May be purchased from tool companies)

Higgins Ink Co. Inc., 21 Ninth St., Brooklyn 15, N. Y.
Techniques — 50 cents
Script and Manuscript — 50 cents
Cartooning — $1
Arts and Crafts Projects — $1
History of Ink
Biography of Chas. M. Higgins
Higgins Color Bottle Base

The Home Craftsman, 115 Worth St., New York, N. Y.
One Evening Projects — 50 cents
Craftsman Silhouette Book — 50 cents
How to Lay Linoleum — 10 cents
How to Hang Wallpaper — 10 cents
The Home Craftsman Magazine — $1.50 per year

Hunt Pen Co., Howard C., Camden, N. J.
Elementary Alphabets and Their Construction — 15 cents
Pen Tips on Cartooning — 25 cents
Textbook of Lettering Poster Design — 50 cents
Block Printing with Linoleum — 25 cents
Linoleum Block Printing with Color — 50 cents

Industrial Arts Cooperative Service, 519 West 121st St., New York 27, N. Y.
Arts and Crafts Catalog — 10 cents
Descriptive Catalog of Publications — 10 cents
Work and Play Materials for Children from 2–7 — 10 cents
Our Co-op, Industrial Arts in the Elementary School — 25 cents

LePage's, Inc., Gloucester, Mass.
Le Page's Glue and Other Adhesives
Le Page's Craft Creations in the Modern Manner
Modern Adhesives and How to Use Them
Glue Facts for Industrial Arts Instructors, Home Craftsmen, "Handy" Men, Mechanics, and Hobbyists

National Soap Sculpture Committee, 160 Fifth Ave., New York 10, N. Y.
A Soap Sculpture Manual

Ohio Leather Co., 1052 North State St., Girard, Ohio
The Story of Leather

Plymouth Cordage Co., North Plymouth, Mass.
Useful Knots and How to Tie Them
Lift It Safely
Rope on the Farm
How to Put Rope to Work in Industry

Pratt Co., G. A., East Chicago, Ind. 1108 W. Chicago Ave.
Catalog of Bookbinding Equipment, Tools, and Supplies
How to Make Rubber Stamps

The Related Arts Service, 511 Fifth Ave., New York 17, N. Y.
The Urge to Make

(To be continued)

Problems and Projects

MODERN COPPER VASE

HOMER C. ROSE
Alexandria, Va.

The square copper vase, shown in Figure 1, is modern in design and desirable for the display of living plants such as ivy or philodendron, or dried stalks or leaves such as bittersweet, Chinese lanterns, or fall foliage. It is easy to construct, yet offers a good opportunity for the selection and modification of surface design, and when finished, it is attractive and worth several times the cost of materials used in its construction.

BILL OF MATERIAL

1 pc.	6½ x 12 3/16-in.	28-ga. copper
1 pc.	2 15/16 x 2 15/16-in.	28-ga. copper

Suggested Procedure

1. Cut the sheet metal to the dimensions shown by the bill of material.

2. Make additional cuts as indicated in Figure 2.

CAUTION: Cut to end of tin shears to avoid marking the metal beyond the cut.

3. Mount the copper on a piece of wood, holding it in place with tacks, as illustrated in Figure 3.

4. Work out a design for the sides of the vase. Figure 4 shows suggested designs.

5. Procure a chasing tool such as is shown in Figure 3. A small piece of drill rod or a piece of carbon steel may be shaped, hardened, and tempered to make this tool. The end should be slightly rounded and polished so that it will not cut the metal.

6. Transfer the design to the metal by use of carbon paper or by cutting out the design and tracing around it.

Fig. 1. Modern copper vase

7. Tap along the lines with the chasing tool to form the design. Care should be taken to keep the lines even and smooth, and be sure not to cut through the metal. It may be desirable to practice on a piece of scrap stock prior to working on the project.

8. Bend the hem at the top of the piece with the bar folder, or form it over the square corner of a piece of hardwood with a mallet. The edge of the hem should be left slightly rounded, not flattened, and then continue the bend to form a hem.

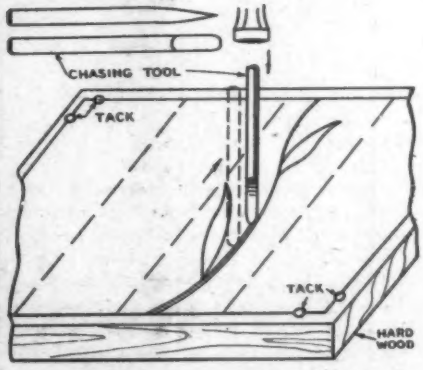


Fig. 3. Chasing tool to form design in the sheet metal

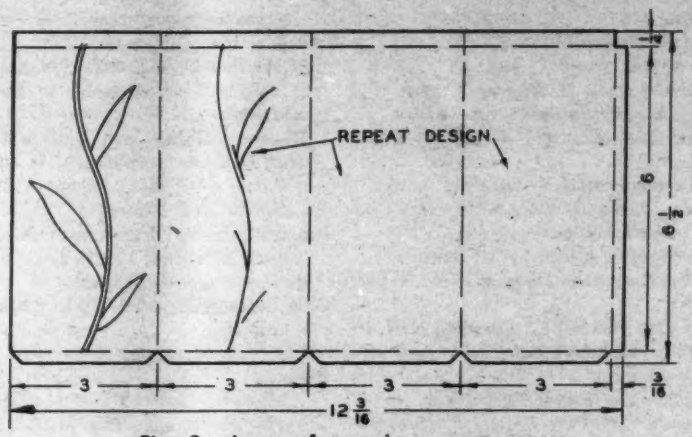


Fig. 2. Layout for modern copper vase

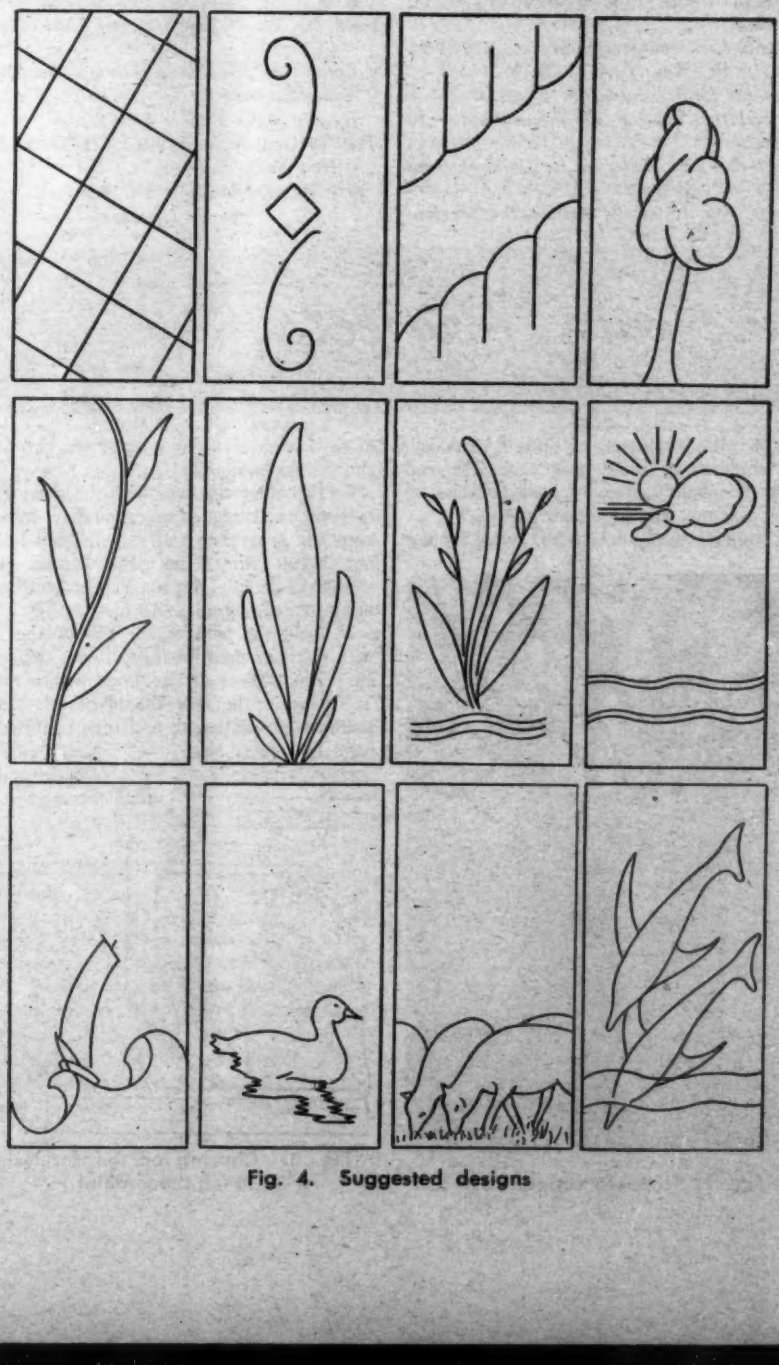


Fig. 4. Suggested designs

9. Bend the edge at the bottom of the piece to 90 deg., in the bar folder or over the edge of a piece of hardwood.

10. Bend the metal at the end of the piece to 90 deg., as in previous step.

11. Form the metal over a piece of wood held in the vise. It is desirable that corners be slightly rounded. This can be accomplished by carefully bending the material with the hands. A hammer or mallet should not be used.

12. Check the piece for squareness and make sure that the edges forming the lap seam fit smoothly.

13. Solder the seam along the inside of the vase by first tacking and checking for fit and then by flowing solder along the entire seam. Care sould be taken to keep the solder from flowing through the seam thus allowing it to show on the outside of the vase.

14. Insert the bottom. Slight trimming at the corners may be necessary.

15. Place the piece bottom side up over a 2-in. piece of wood or pipe so as to hold the bottom up against the flanges. Solder around the entire seam.

16. Rub the entire surface of the project with fine steel wool.

17. Clean the piece.

18. Apply lacquer finish.

Alternative Suggestions

The vase could be made of sheet or galvanized iron and finished with an imitation copper finish.

Aluminum or stainless steel could be used to make a very attractive modern vase.

Each of the four sides could be a separate piece with a neat riveted joint showing on each corner. Rivets should be roundhead and spaced about ¾ in. apart.

For large bezels, such as very large rings, brooches, and bracelets, the scallops can be stamped for further ornamentation. Scallops and points are also easier to force down over the stone and consequently, heavier silver can be used which is sometimes advisable for very large stones.

There are numerous ways to further ornament a setting, such as adding a ring of twisted wire or a row of *raindrops* around the bezel.

All in all, the bezel is a very important part of Indian silversmithing, and after trying out a few of them you will find them not only interesting but surprisingly simple to make.

INDIAN SILVERSMITHING

BEN HUNT
Hales Corners, Wis.

(Continued from page 344 of the October, 1947, issue)

Bezels

Before going into more intricate silversmithing it may be well to devote a chapter to bezels, because they play such an important part in the making of silver and turquois jewelry. Bezels are made of 26 to 28-ga.

sheet silver. Pure silver is best for this purpose because it is softer and does not melt so easily, but very few, if any, Indians use it. The regular sterling or coin silver, which is always on hand, is either hammered or rolled to the gauges mentioned. The thinner or 28-ga. is used for small bezels and the 26-ga. for the larger ones.

Regardless of the type or design of jewelry, a bezel is required and its size is determined by the stone to be mounted. The drawings on Plate 11 will give you a pretty good idea of the different kinds of bezels, and inasmuch as the general procedure is the same on most of them, we will describe the plain type as shown at the upper left. As stated before, the type and size of the stone determine the size of the bezel. Some stones, like the low cabochon, can be set if so desired. This calls for a high bezel. A high cabochon can be set with a low bezel.

To start, the silver must be annealed. If it is a long piece, coil it and place it on the soldering frame. Heat it to a cherry red and plunge it into cold water. This makes the silver soft and pliable. Straighten it out and clean it with crocus cloth or fine pumice and water, or whiten it by immersing it in a hot pickle bath, but don't forget to take off any iron wire that may be used in binding the silver, before plunging the silver into the hot bath. Another method is to take off the iron wire, heat the bezel silver and drop it into the cold pickle. The results are the same. Now twist one end around the stone to get the approximate size and cut off the surplus. Then form it carefully to the shape of the stone, allowing just a very little clearance, so that the stone will fit without being forced into it. The ends of the bezel should butt together accurately in order that a good solder joint is obtained. For large bezels it is desirable to wire them for soldering the joint. This is not always necessary, however, and experience will soon tell when and when not to use the binding wire. There are two ways of soldering the joint, one being to solder it first as a separate operation and the other being to solder the joint, and the bezel to the base, in the same operation. To solder the joint first, proceed as you would in soldering a small ring, regardless of the size of the bezel.

This is frequently done to insure a good fit. For most bezels up to ½ or ¾ in., it usually is advisable to solder the whole thing in one operation. You will, no doubt, do a little experimenting on this score to see how each method works.

The bottom of the bezel must be a perfect fit on the base to which it is to be soldered. Uneven places can be taken down with a flat file. The solder snippets are placed on the inside, about ¼ in. apart, and if the joint is to be soldered at the same time, lay a snippet against or over the joint on the inner side. See the sketch of the *plain bezel* shown at the upper left-hand corner of Plate 11. The piece of solder for the joint should be at least as high as the bezel. Apply flux and play the flame on the work, being careful not to heat the bezel more than the base, or the solder will simply run *up* on the bezel. On the other hand, if the base is heated more than the bezel, the solder will just run over it and not touch the bezel at all. When both are heated evenly the solder will flow evenly around the base and along the joint. Remember to keep the parts clean.

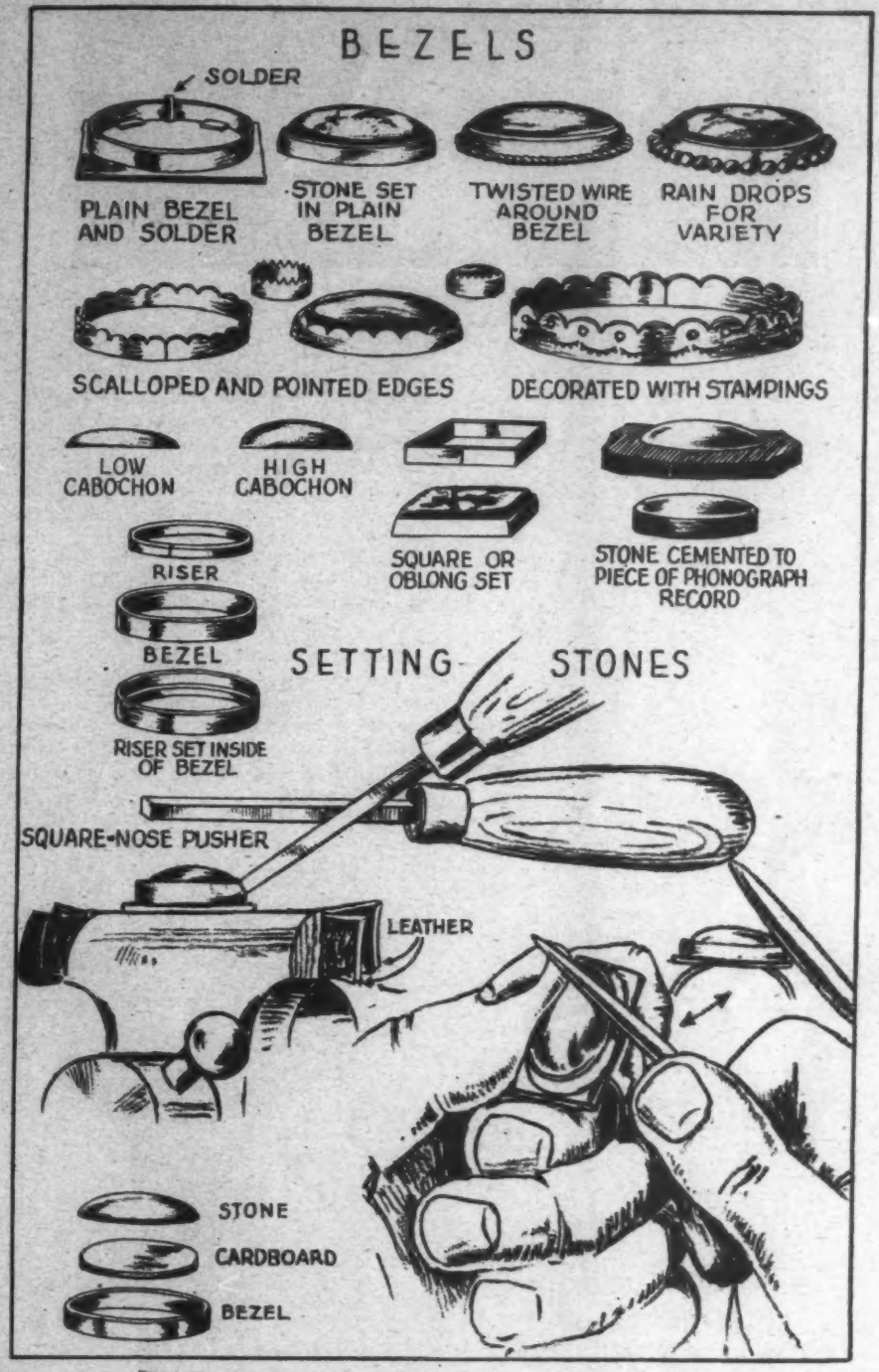


Plate 11

Usually stones are mounted on level surfaces, but there are times when this is not practical. In that case the bottom of the bezel must be filed to fit the base or support. The top edge of the bezel is always level. When a stone is placed in such a bezel a riser or support is placed inside it to give the stone a solid and level base all the way around. When mounting a low cabochon in a high bezel, this inner supporting ring is also used, although sometimes a piece of silver wire, bent to fit around the inside of the bezel, is enough to set the stone to the proper height. Very thin

Three kinds of bezels
Notice the high mounting on the brooch. A ring of wire was used for the riser, to set the stone higher

stones are sometimes cemented to a piece of phonograph record with DuPont or Testor's or some other cement of that type. The record material is then filed to the shape and height desired. Of course, it must be set so that none of the black record material shows. See Plate 11. It must be remembered also that the stone must be set into the bezel when everything else is finished, since heat may ruin a stone and liver of sulphur discolor it.

When everything else is finished a piece of blotting paper or cardboard is cut to fit inside the bezel, as shown in Plate 11 at the lower left. The stone is set over it and the top of the bezel is gently forced against the stone. This can usually be done with a smooth burnisher of hard steel or agate as shown at the lower right in Plate 11. Sometimes a pusher works better. In that case the ring is clamped in a vise between two pieces of leather to prevent marring it, and the edge of the bezel is pushed down evenly all around. Sometimes you may even have to use a small wooden mallet to force down the bezel. The upper edge should fit close all around the stone. After using the pusher the burnisher is used to even up the edge or you may even have to use a small file to smoothen it. The cardboard is placed under the stone to take up any shock as it cushions the stone in the bezel.

For variety, filed edges on bezels are rather attractive. The filing is usually done before the bezel is soldered and after the exact length of the metal has been ascertained. A good way is to straighten it out and divide it evenly so you will come out right with the scallops or points, as the case may be.

A MILKING STOOL AND A FERN STAND

JOHN W. DEAN

Arlington Heights, Ill.

De Luxe Milking Stool

This project developed in a junior high school shop out of the definite needs of several of the boys who came from farms or lived on the outskirts of the town. Many of them did the milking and felt that they should have the very best milking stool that could be made.

After some efforts had been made by the trial and error method to make such a stool, the one shown in Figures 1 and 2 was designed.

Figure 2 shows the construction, and Figure 3 shows a good layout for the leg, using boards 8 in. wide. A 1-in. Forstner bit was used for drilling the four holes which give the uniform curve to the sides. With this method the sawing could be done with a hand ripsaw. The layout shown in Figure 4 was made so that the leg could be cut out on a band saw and finished with a chisel, spokeshave, and block plane. The hand holds can be cut with the band saw or a coping saw. The edges of the hand holds were rounded off and smoothed with sandpaper. In fact, all the arrises of the leg should be slightly rounded.

The top consists of an 8-in. square with the corners cut off about an inch, as shown. Round or chamfer the edges about 1/16 in. The under piece consists of a 6-in. square with the under-edge chamfered ¼ in. The board for the leg may be from 8 to 12 in. long; with the two top pieces in place the stool should be from 10 to 14 in. high.

The parts of the leg were glued and nailed together as is shown clearly in Figure 2.

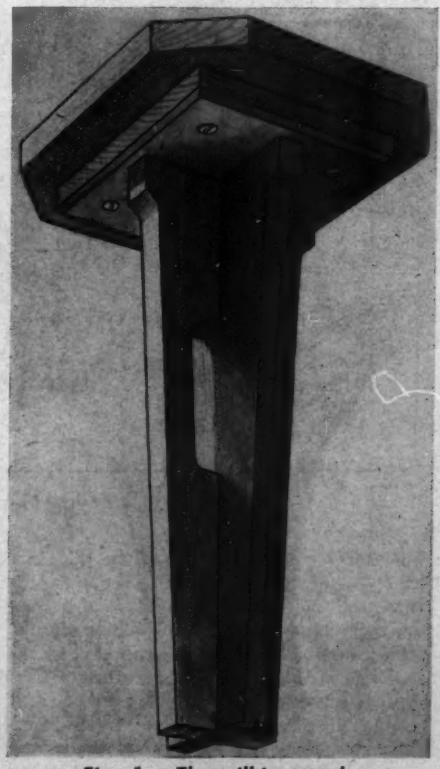


Fig. 1. The milking stool

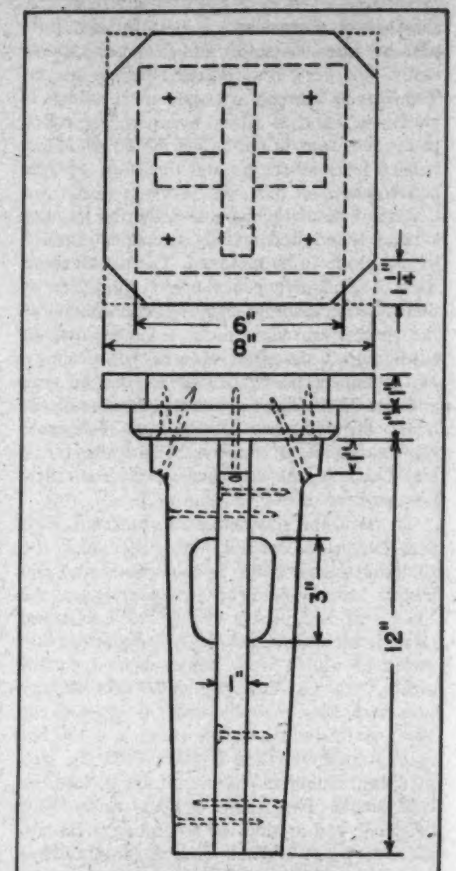


FIG. 2 SIDE VIEW SHOWING NAILS AND SCREWS

Assembly of the leg

The smaller square top piece had been chamfered about 1/3 of its thickness on its lower edges. Diagonals were drawn on this side and holes drilled and countersunk for screws as far out from the center as possible. Diameters were drawn on the other side to aid in locating the nails which were then driven into the top of the leg. Glue should be applied before nailing.

Diagonals were drawn on the bottom of the top piece making it easy to square up the rest of the stool onto the seat and nail and screw them together. Start the screws or nails enough to hold the position, and then apply glue or paint to the two surfaces, and drive in the nails while the glue is still fresh. Then set the screws, and paint it all over. When thoroughly dry, a second coat of porch floor paint was added, for the boys meant that they should "last forever."

Fern Stand or Taboret

The fern stand or taboret shown in Figures 5 and 6 was a direct development of the milking-stool design. This type of stand may vary from 18 to 36 in. in height.

The construction is clearly shown in Figure 5. The procedure is much the same as for the milking stool except that the fastening for the

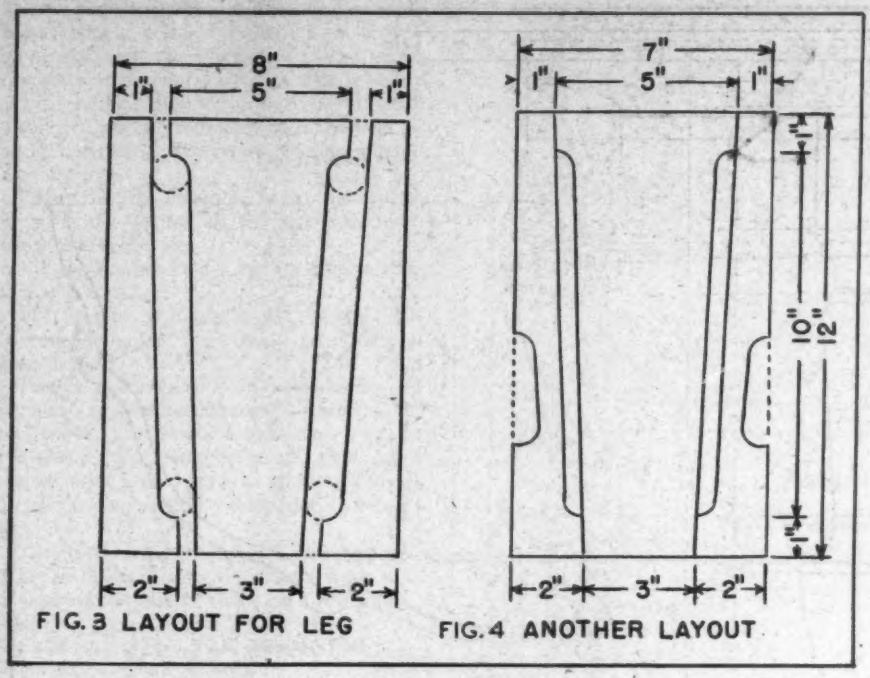


FIG. 3 LAYOUT FOR LEG

FIG. 4 ANOTHER LAYOUT

Layouts for the leg

TILT-TOP TABLE

J. ALFRED SEITZ

Princeton, N. J.

Such great men as Chippendale, Hepplewhite, Duncan Phyfe, and others have given us furniture of graceful design and lasting beauty. Reproductions of these fine pieces and furniture following the basic lines of these great designers characterize our better furniture of today. A most important phase of industrial-arts training should include the study of periodic furniture to give to the students an appreciation of quality in design. As a further emphasis, students should be guided in choosing well-styled projects which they will always be proud to call their own.

For the student who has had some shop experience this piecrust tilt-top table will offer a challenge to his abilities, intrigue his interests, and give him a piece of occasional furniture which will always occupy a favorite spot in his home.

BILL OF MATERIAL

No. of Pcs.	*Name of part*	*Size*
3	Legs	1¼ by 4½ by 14
1	Column	3¼ by 3¼ by 22¼
2	Braces for top	¾ by 1½ by 18
1	Support block	1¼ by 4 by 4
1	Top	⅞ by 24 by 24

Before beginning the table it is advisable to make a pattern for the legs. To do this lay out 1-in. squares on a piece of heavy paper or bristol board. Lay out the outline for the legs on the squared paper to match the drawing, and cut out along the lines. Do not forget to allow for the dovetail joint which fits into the column. A permanent template can be made

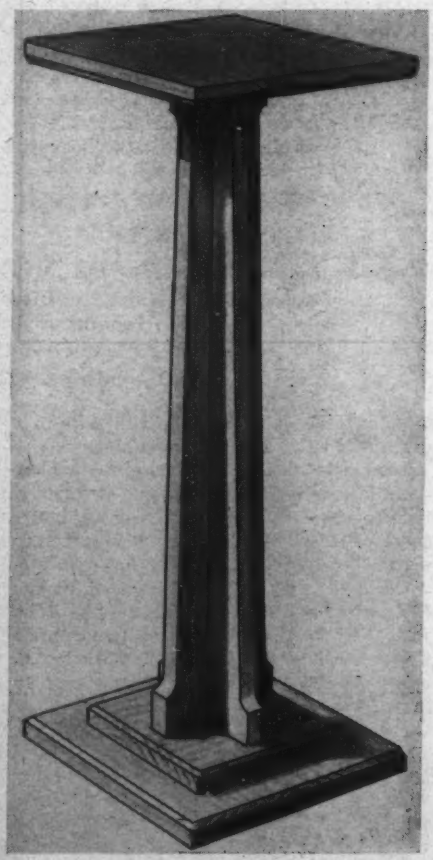


Fig. 5

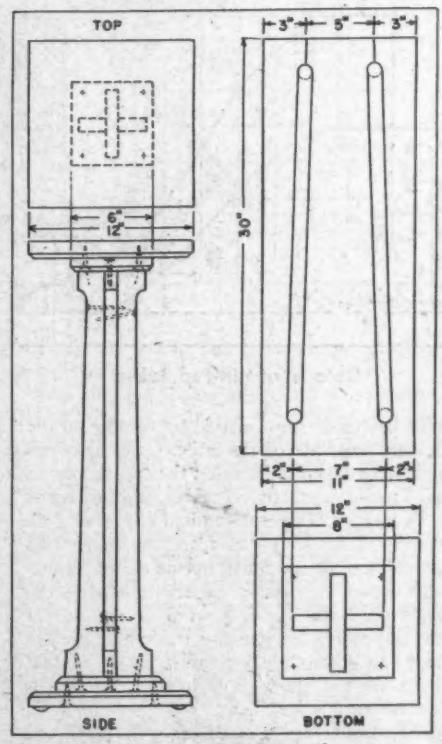
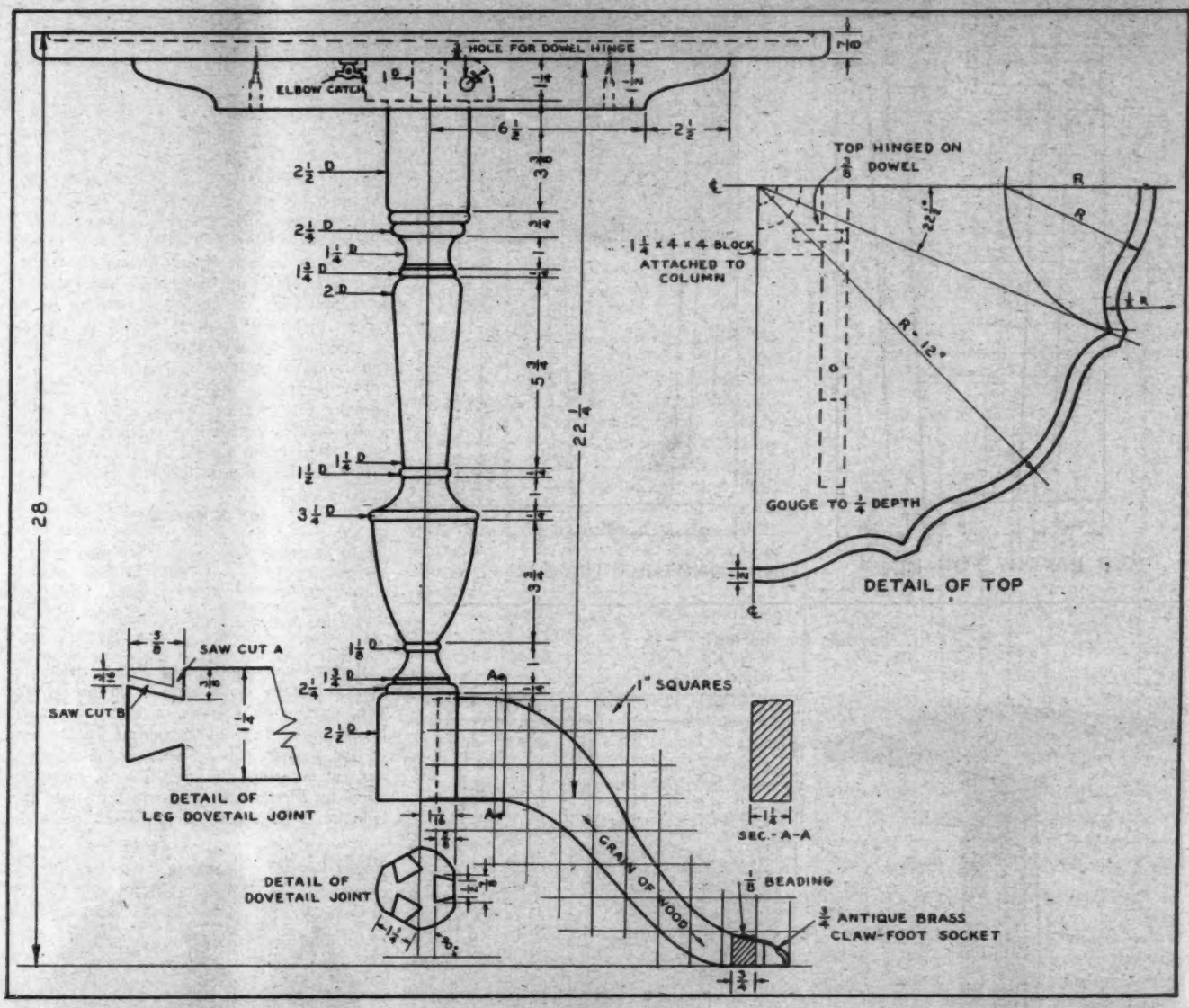


Fig. 6. Fern stand

bottom is all from the underside, and the top is just the same except that it is on the small end of the leg. All of the flat pieces are chamfered about ¼ in. After the finish has been applied four steel glides were driven into the bottom, as shown.

Tilt-top table



Details of tilt-top table

of ¼-in. plywood or 24-gauge sheet metal. It is suggested that a hardwood such as mahogany, black walnut, or cherry be used for making this table.

Constructing the Table

The construction of the table may be started by cutting the legs out of stock of the correct size. Remember to lay out the legs so that the grain of the wood runs in the direction shown on the working drawing. Do not taper the legs until after the dovetail joints have been cut.

The column may be made from stock 2½ in. square and 25 in. long; this allows extra length for waste. Build up the column by gluing stock ½ in. thick and 4 in. long at the place where the turn is to be turned, thus reducing the amount of waste. Turn the column accurately to exact dimensions.

The pattern for the top should first be laid out on a piece of heavy paper. An optional round top may also be used by turning on the outside faceplate of the lathe. Care, however, should be taken in securing the top tightly to the faceplate, exactly on center, and turning at a slow speed. The top is routed out to a ¼-in. depth, ⅜ in. to ½ in. from the edge. This process can be simplified by the use of a portable router or a router cutter attached to the high-speed drill press. A word of caution: If the top pieces are joined with dowels, be sure that the dowels are set below center so that they will not show through when the top is routed out.

The braces are selected of ¾-in. stock and jointed to 1½ in. in width. The two braces may be tacked together while the design is being cut on both ends. Drill four 3/16-in. holes in each brace for the screws.

Cut a 4-in. square block from 1¼-in. stock, and round off one edge to a radius of ¾ in. so that the top can be tilted. A 1-in. hole is drilled through the center to secure the column in place. Drill ⅜-in. holes in both sides to a depth of 1 in. to hold the dowel hinge pins.

The most difficult construction problem arises in cutting the dovetail joints accurately. Careful organization and measuring will insure good joints. Using a framing square, check to see that the legs are absolutely square.

To a depth of ⅜ in. cut a groove on the circular saw ⅜ in. from the outside edge of the joint. See Saw Cut A of detail drawing. Do this on both sides of each leg. Tilt the saw to an angle of 18 degrees and cut a groove 3/16 in. from the edge to a depth of ⅝ in. See Saw Cut B of detail drawing.

Before beginning to cut the dovetail joint in the column, make a pattern of 20-gauge sheet iron to correspond to the full-scale detail plan of the leg. Lay out the two joints accurately on the bottom of the column. With a sharp chisel level off the column to a width of 1¼ in. at the place where the legs are to fit. Now accurately score a center line on the

leveled sections of the column. On the drill press (with a ½-in. Forstner or multi-spur bit) mortise out the joint to a depth of ⅝ in. Complete each joint carefully with a sharp chisel, checking frequently with the full-size metal pattern for accuracy. When the joint is nearly complete, make several trial assemblies with the legs.

Taper the legs from 1¼ in. at the top to ¾ in. at the toe, cutting half the taper from either side of the legs.

Cut a ⅛-in. bead along the top edges of the legs with a router.

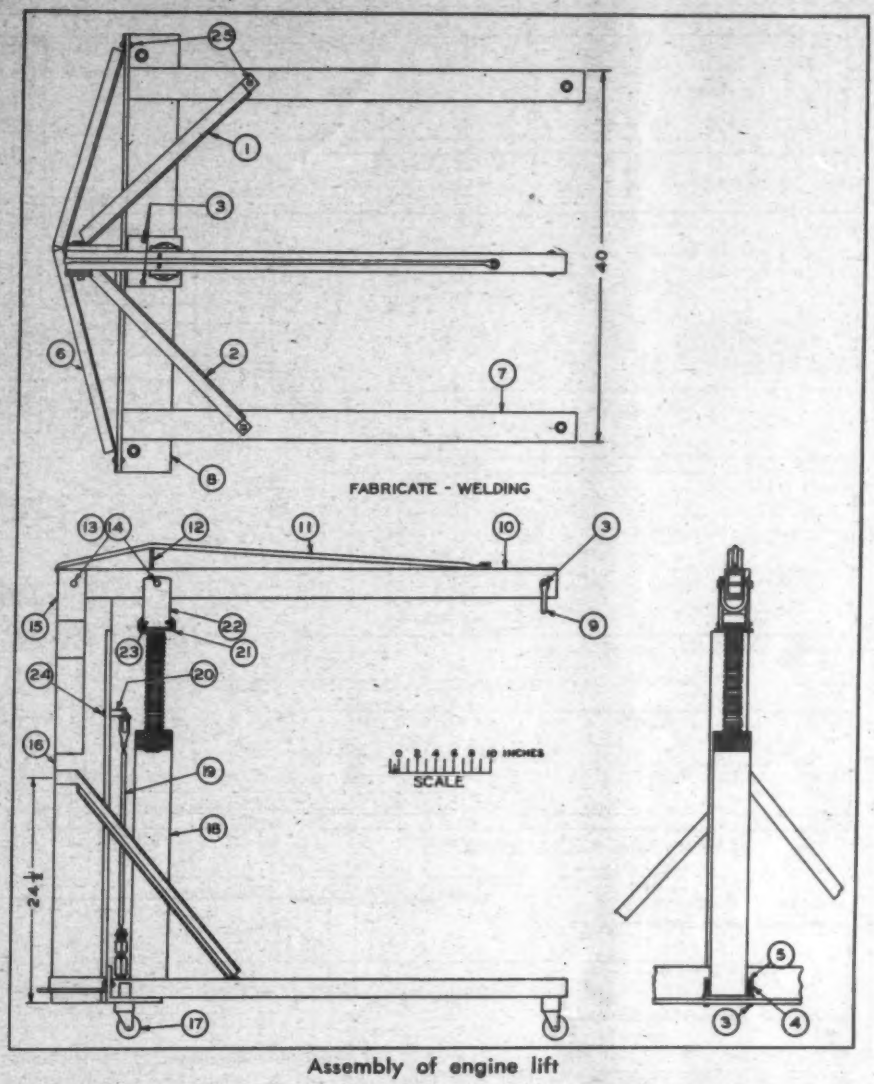
Fit the brass claw-foot sockets to the toes, but do not nail in place until the table has been finished.

Prepare the surfaces of all pieces before assembling by sanding thoroughly, removing all tool marks, scratches, and blemishes.

Make a trial assembly before gluing. Assemble, using a good grade of glue and removing all excess glue with a damp cloth before it sets.

The finish of any project is very important. Many of the excellent commercial finishes can be used successfully by following a few simple rules:

1. Remove all glue, and sandpaper project thoroughly with fine sandpaper.
2. Stain to suit the desire of the individual making the table.
3. Use a filler on all open grain woods (either a commercial paste filler or successive coats of shellac until a smooth surface is obtained).
4. Brush or spray all finish coats on *thinly*.
5. Rub thoroughly between coats with fine steel wool or sandpaper.
6. Rub final coat with powdered pumice stone, and rotten stone if desired.



Assembly of engine lift

ENGINE LIFT MADE OF WAR SURPLUS MATERIALS

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Santa Barbara, Calif.

War surplus, headache or inheritance, seems to be the lot of the schools of America, particularly the industrial-arts departments within regular school systems.

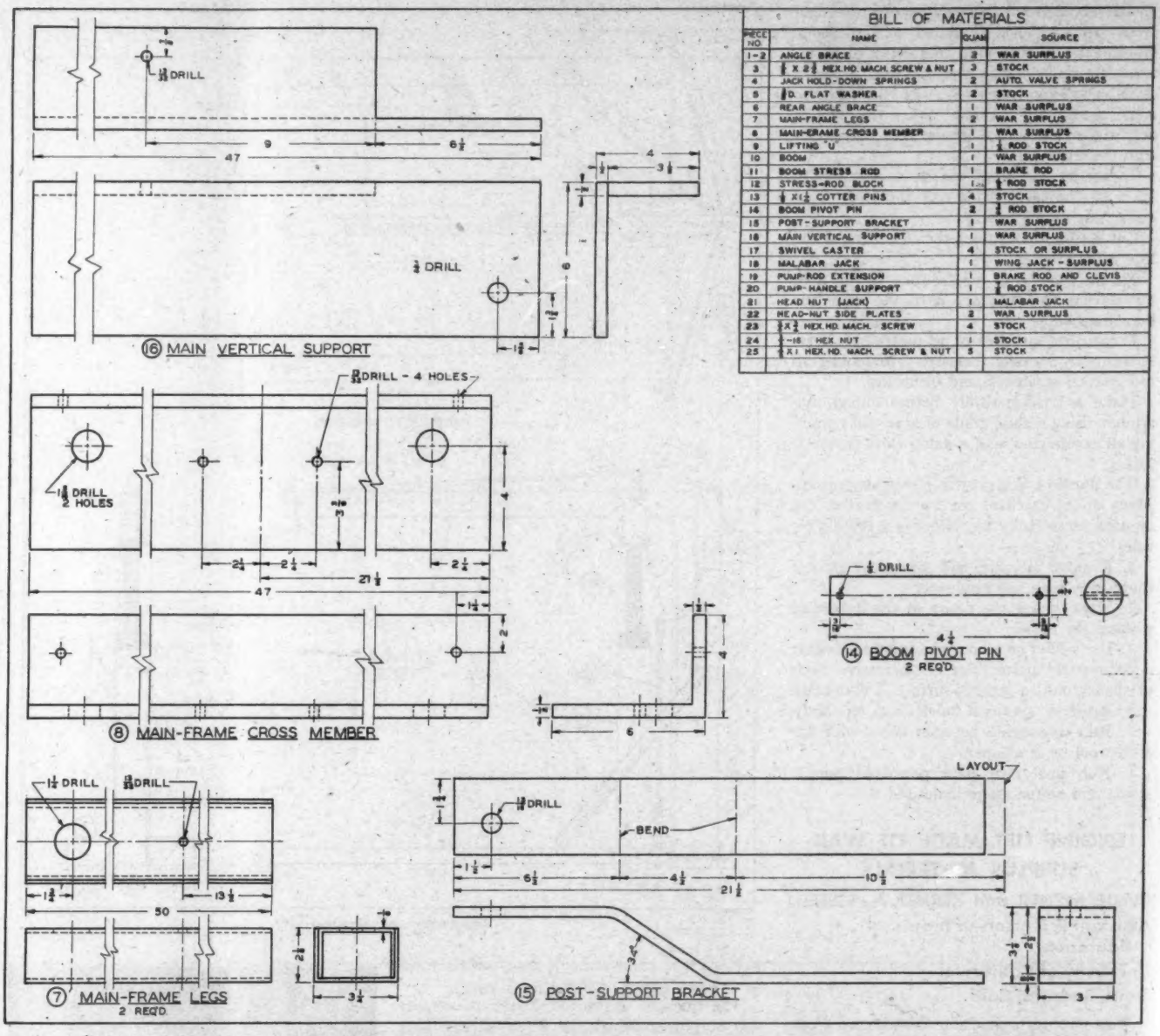
Engine lift

The question is asked, should we acquire war surplus materials, or if we already have acquired them, what shall we do with them? It is a foregone conclusion that all, without exception, have welcomed machinery and equipment, particularly surplus that could be put to work by merely setting the machine and connecting electrically. The real challenge that faces the industrial-arts teacher is what to do with sheets of heavy metal, extruded forms, copper rings, and other odd shaped metal? To be sure it is good material and can be fabricated into worth-while projects but what kind of project and what design?

Utilization of surplus stock metal is one problem but still more challenging is the disposition of monstrosities that appear along with many shipments. What would the industrial-arts teacher do with an engine service stand for a P.B.Y. service boat, or a wing jack, or other like equipment designed to be used for one and only one purpose.

Engine lift in use

Many of the parts mentioned in the fore-


BILL OF MATERIALS
PIECE NO. | NAME | QUAN | SOURCE
1-2 | ANGLE BRACE | 2 | WAR SURPLUS
3 | ½ X 2½ HEX. HD. MACH. SCREW & NUT | 3 | STOCK
4 | JACK HOLD-DOWN SPRINGS | 2 | AUTO. VALVE SPRINGS
5 | ½ D. FLAT WASHER | 2 | STOCK
6 | REAR ANGLE BRACE | 1 | WAR SURPLUS
7 | MAIN-FRAME LEGS | 2 | WAR SURPLUS
8 | MAIN-FRAME CROSS MEMBER | 1 | WAR SURPLUS
9 | LIFTING "U" | 1 | ½ ROD STOCK
10 | BOOM | 1 | WAR SURPLUS
11 | BOOM STRESS ROD | 1 | BRAKE ROD
12 | STRESS-ROD BLOCK | 1 | ½ ROD STOCK
13 | ¼ X 1½ COTTER PINS | 4 | STOCK
14 | BOOM PIVOT PIN | 2 | ½ ROD STOCK
15 | POST-SUPPORT BRACKET | 1 | WAR SURPLUS
16 | MAIN VERTICAL SUPPORT | 1 | WAR SURPLUS
17 | SWIVEL CASTER | 4 | STOCK OR SURPLUS
18 | MALABAR JACK | 1 | WING JACK - SURPLUS
19 | PUMP-ROD EXTENSION | 1 | BRAKE ROD AND CLEVIS
20 | PUMP-HANDLE SUPPORT | 1 | ½ ROD STOCK
21 | HEAD NUT (JACK) | 1 | MALABAR JACK
22 | HEAD-NUT SIDE PLATES | 2 | WAR SURPLUS
23 | ⅜ X ¾ HEX. HD. MACH. SCREW | 4 | STOCK
24 | ⅜-16 HEX. NUT | 1 | STOCK
25 | ¼ X 1 HEX. HD. MACH. SCREW & NUT | 5 | STOCK
⑯ MAIN VERTICAL SUPPORT
⑧ MAIN-FRAME CROSS MEMBER
⑭ BOOM PIVOT PIN 2 REQ'D.
⑦ MAIN-FRAME LEGS 2 REQ'D.
⑮ POST-SUPPORT BRACKET
LAYOUT
BEND

Details of engine lift. See next page for more details

going can be used for the fabrication of equipment that is needed in the ordinary school shops. Auto shop equipment lends itself to reprocessing of otherwise useless surplus. An engine assembly stand, transmission jack, or an engine lift are some of the possibilities.

Both detail and assembly drawings show how to fabricate an engine lift from a Malabar wing jack and an engine service stand. Only a few small pieces were purchased or made for the lift. The entire hydraulic jack is used as it is and the girders and other parts were merely cut to length with a cutting torch and then fabricated. Both bolts and welding are indicated as fabricating procedure, the bolts or machine screws functioning as a holding device for welding.

See next page for more details of engine lift.

MAKING AND HOLDING METAL SPINNING CHUCKS

HAROLD S. BEAL

East Rochester, N. Y.

When doing metal spinning, regardless of the type lathe used, it is necessary to hold wood or metal chucks to the spindle nose in some manner. On most lathes that are especially designed for spinning metal a coarse threaded cone center is used as illustrated in Figure 1. The block of wood to be used for the chuck is first countersunk as close to the center of the block as possible with a tool ground at the same angle as the screw lathe center. The wood piece is then screwed on to

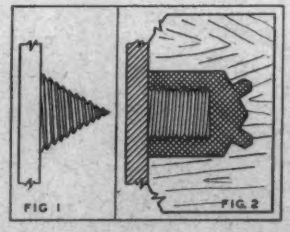
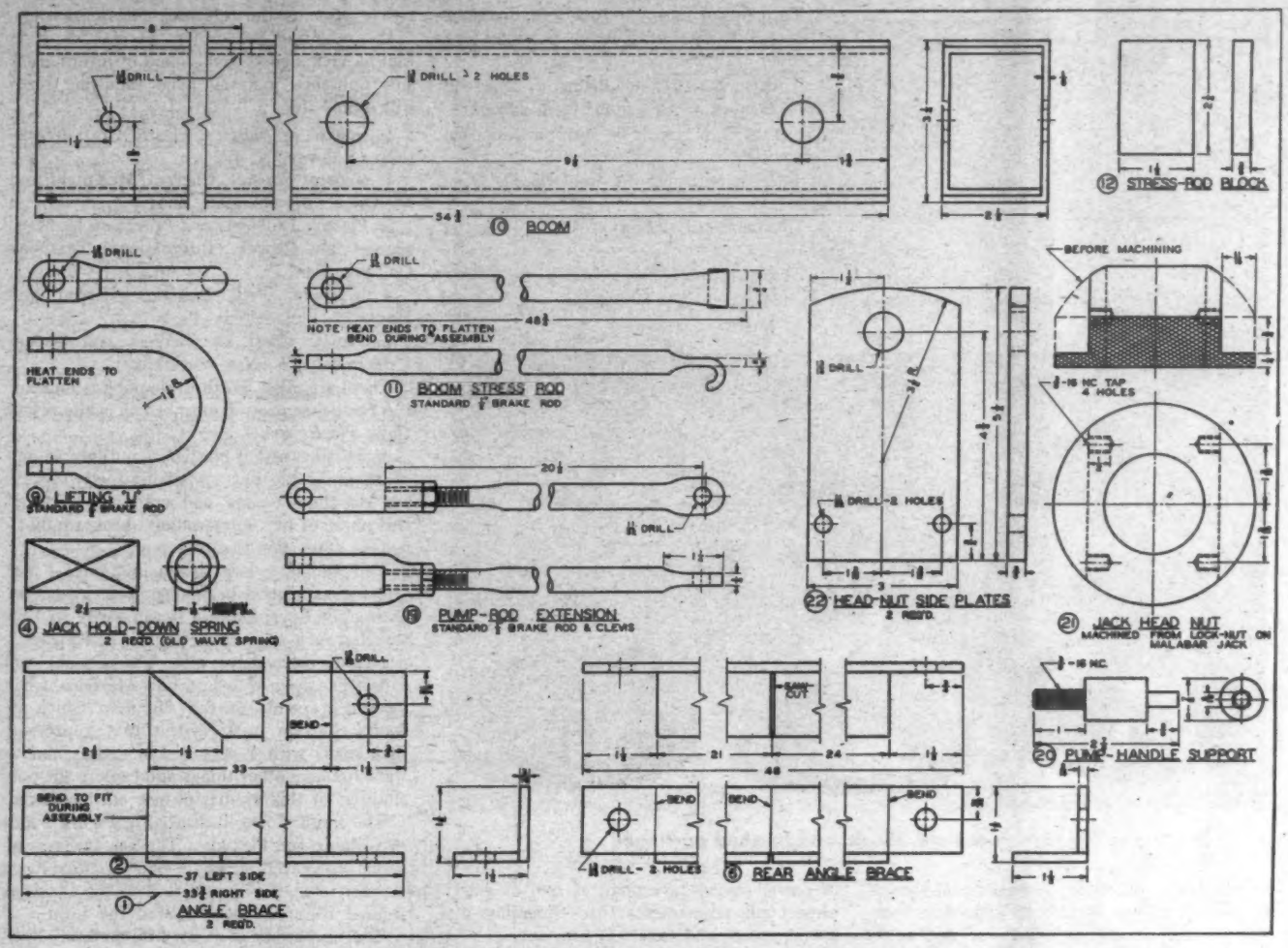


Fig. 1. Coarse-thread cone center

Fig. 2. Spindle-nose thread embedded in wood block

the tapered thread until the block is tight to the plate. After the form is turned and used, the chuck can be removed and replaced for additional work. In most cases, however, it



Details of engine lift. See article and more details on pages 387 and 388

will be necessary to turn the chuck down slightly as it will not come to rest at exactly the same position every time it is replaced, and will be off center.

If a wood turning or engine lathe is used for spinning, the wood block can be secured to the spindle in two ways. The first method is to drill a hole much larger in diameter than the spindle nose into the wood block. This hole should be deeper than the length of the thread on the spindle. See Figure 2. Smaller holes should be drilled at irregular intervals and at various depths and angles in the side and bottom of the larger hole, as shown, so the lead core will hold itself in position. Lead is poured into the hole, drilled out, and tapped to fit the lathe spindle thread.

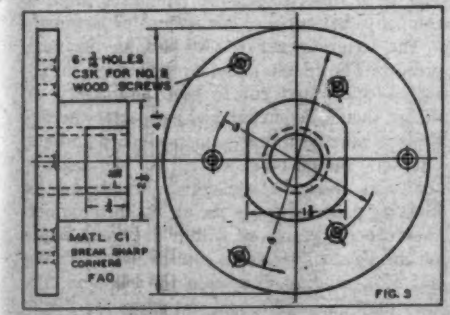


Fig. 3. Faceplate made for the school lathe

The second and probably the best method to hold the block is on a faceplate. The chuck can then be left on the faceplate until the project is completed. The faceplate and chuck as a unit can be removed from the lathe and replaced and will always be on center, eliminating the necessity of re-turning the chuck. Of course, it will be necessary to have several faceplates.

Past experience over several years shows that 15 faceplates are sufficient per lathe for the needs of from 25 to 30 students taking general metal, general shop, and wood turning.

Metal chucks are used where a large number of articles are required, and where accuracy is important. The metal chucks will not shrink or warp, as wooden chucks will under constant use due to heat generated during the spinning and trimming process. When a metal chuck is desired, make a wood shell pattern about ⅜ in. thick, of the required design (be sure to allow for machining) and have the pattern cast in brass or bronze. Machine the rough casting to fit a faceplate and fasten together with machine screws. Mount the faceplate and casting as a unit on the lathe to be used for spinning. Grind a few worn-out 10 or 12-in. files to the same shape as wood turning chisels but with less clearance, and by using the lowest speed, the metal chuck can be turned the same as wood. Great care should be exercised not to drop, nick, or dent the finished chuck.

Very few schools are equipped with metal spinning lathes but most shops have at least one wood turning or engine lathe that can be used for spinning, providing they are rigid enough to stand the thrust necessary for the operation. In most cases the shop has a limited number of faceplates.

If the cost of additional faceplates seems prohibitive, a pattern can be made from which additional plates can be cast, and will give the students valuable experience and firsthand knowledge of shrinkage, draft, fillets, core prints, and core boxes, which are all important in the patternmaking trade.

The machining of the faceplate casting is

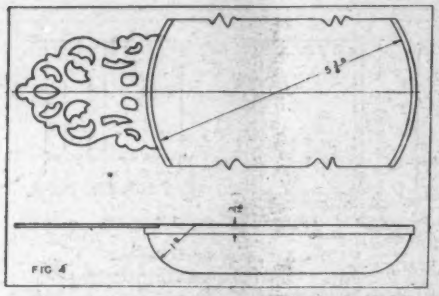


Fig. 4. Porringer made by spinning

Fig. 5. Faceplate, chuck, and finished porringer

an excellent problem for general metal classes. It involves facing, turning to a shoulder, boring, internal threading, laying out, and countersinking screw holes, hack-sawing and filing flats to fit the lathe wrench. If a shaper or mill is available, the wrenchflats can be machined on the faceplate.

The procedure and drawing of the faceplate in Figure 3 is made to fit a No. 12 Yates American wood turning lathe.

The drawing of the porringer in Figure 4 gives chuck sizes. The bowl was spun from a 16-ga. pewter disk 6¾ in. in diameter and the top edge spun back 3/16 in. The handle was cut from a piece of 14-ga. pewter and soldered to the rim with 60–40 soft solder.

Figure 5 shows the wood pattern of a faceplate, the faceplate casting, and the finished cast iron plate, the wood pattern for the metal chuck and the finished chuck fastened to a faceplate. The porringer in the picture and in Figure 4 was spun over the metal chuck. It makes an excellent receptacle for serving breakfast foods, jellies, pickles, candy, nuts, and also can be used as an ash tray.

Operations for Machining Faceplate

1. Install independent 4-jaw chuck. Reverse jaws if necessary to hold faceplate.

2. Center faceplate, have hub facing tailstock, use chalk, see that left side of faceplate is against jaws of chuck, and tap with lead or bakelite mallet, if necessary.

3. Turn rim of faceplate to 4⅜-in. diameter and as close to jaws of chuck as possible, face right side.

4. Turn hub to 2⅛ in. diameter, face end of hub so it projects 1¼ in. from rim.

5. Set up boring tool. Be sure point of tool is on center.

6. Bore cored hole in hub to 31/32-in. diameter.

7. Change gears on left of lathe to cut 8 threads per inch.

8. Sharpen threading tool to fit center gauge. Set up internal threading tool with aid of center gauge, have point of tool on center, inspect all adjustments, use threading dial, lowest speed, and take 0.005-in. cut.

9. Cut threads to fit gauge, remove chuck from lathe and test on wood lathe spindle nose. Note setting of ball cranks; be careful back gear does not slip out when removing chuck from engine lathe.

10. Cut two rings 3 and 4 in., respectively, for location of screw holes.

11. Remove faceplate, reverse, rechuck and center, using indicator.

12. Face rim of faceplate to ⅜ in. thickness.

13. Remove faceplate.

14. Divide 4-in. circle into 6 equal parts, spot and drill every other space with 3/16-in. drill, using center square, mark 3-in. circle from points not drilled on the 4-in. circle, drill three 3/16-in. holes.

15. Countersink all holes for No. 8 flathead wood screw.

16. Cut and file hub as per drawing for wrench.

SHORT COURSE IN PLASTICS

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Longmeadow, Mass.

For the benefit of other industrial-arts teachers who would like to bring in up-to-date information, and simple projects in plastic which will arouse interest, the author of this article presents the following information.

In presenting the subject of plastics, it is well to have a good background of information and reference material. The following texts will supply this.

1. *Course in Plastics,* Plastic Craft Workshop (Rahway, N. J.)

2. *General Plastics,* Cherry (McKnight and McKnight, Bloomington, Ill.)

3. *Plastics Problems and Processes,* by Mansperger and Pepper (International Textbook Co., Scranton, Pa.)

4. *Working With Plexiglas* (Rohm and Haas Co., Philadelphia, Pa.)

5. *Plastic Craft* by DeWick and Cooper (Macmillan Co., New York City)

There are other worth-while publications but the foregoing proved most worth while, especially *Plastic Craft.*

A short history of plastics as outlined in any of these books, plus a few finished projects for the class to see and appraise, launched this phase of our industrial-arts program off to a good start. See Figure 1.

The wall bud vase shown in Figure 2 was selected as a good beginning project for seventh-grade boys, because it can easily be constructed in a very few minutes, and makes a practical, inexpensive gift. The student will experience a thrill to find how Plexiglas, when heated, responds to the shape to which he wants to form it. It is this first impression that sticks with a person, and causes him to want to make other things and explore the possibilities of this wonderful new craft material.

The simple form illustrated in Figure 2 aids in forming the Plexiglas. The gas furnace, on which is placed a small oven containing a thermometer, is required to heat the Plexiglas so that it can be bent around the form.

The framework of 1- by 2-in. material, lined with sheet metal on the sides (see Fig. 3) prevents the oven from sliding out of place. A piece of sheet asbestos should be placed on the wire rack in the oven. The 24-in. lengths of Plexiglas rods should be heated in a larger oven to nearly 300 deg. F. They are then ready to place in the smaller oven as needed. Wear cotton gloves to prevent burns, and to give more time so that the Plexiglas is not scratched by careless handling. Extreme care must be used to see that the plastic does not come in contact with the oven walls, as it will cause it to bubble. The bend is started on the inside of the form, and ends up around the spool. The ⅝-in. test tubes were purchased from a company that supplies our science department.

The letter opener was chosen as the next project. The blanks may be purchased in assorted colors and cut to size. Originality of design should be encouraged and, after the designs have been drawn on cardboard and cut out, they should be submitted for the instructor's o.k. They are then drawn directly on the masking paper covering the plastic, after which they should be cut out with a fine-tooth blade on the jig saw, or with a coping saw. With the aid of a sanding disk, sanding roll, and file, they may then be brought to the desired shape. Pencil gauging a line down the center of the blade assures a straight, even edge.

Then sand the project with 6/0 wet or dry abrasive paper and water in order to remove file marks. Next inspect carefully for uneven surfaces which should be removed with file and sandpaper, before the job is buffed. Tripoli may be used on the buffer to produce a high gloss. Many other buffing compounds as suggested by plastic manufacturers may also be used. This may then be followed by applying a hard paste wax and again polishing. Care must be used to see that the project is not pressed too hard, or too long, against the buffing wheel as otherwise the plastic may soften or burn. The finished project costing only 20 cents makes a sparkling gift of which one may be proud.

The sawing out of an ornament for a pin may be next presented, because of the tooling experiences involved. The use of drills, needle files, setting screws, etc., go into the making of small, good looking, inexpensive projects that are useful and attractive, yet require but a small amount of material.

The eighth-grade boys found the table-model bud vase, shown in Figure 4, a very attractive challenge. To make the hole for the test tube lay out a center 4 in. from one end of the plastic strip, and 6⅛ in. from the other. Then drill holes with a ⅜-in. drill, and follow with a ⅝-in. drill which should have a negative rake. Heat the plastic to 275 deg. F., and shape around the form shown in Figure 4, made of 1⅛-in. stock. Blocks 1 and 2 are nailed down permanently, and the plastic is started in the slot of block 2. Bring it around this block, and insert nails of block 3 in holes previously drilled, making it possible to continue the curve up around block 1, where it is held in place until it cools slightly. It is then nec-

Fig. 1. Pleasing plastic projects

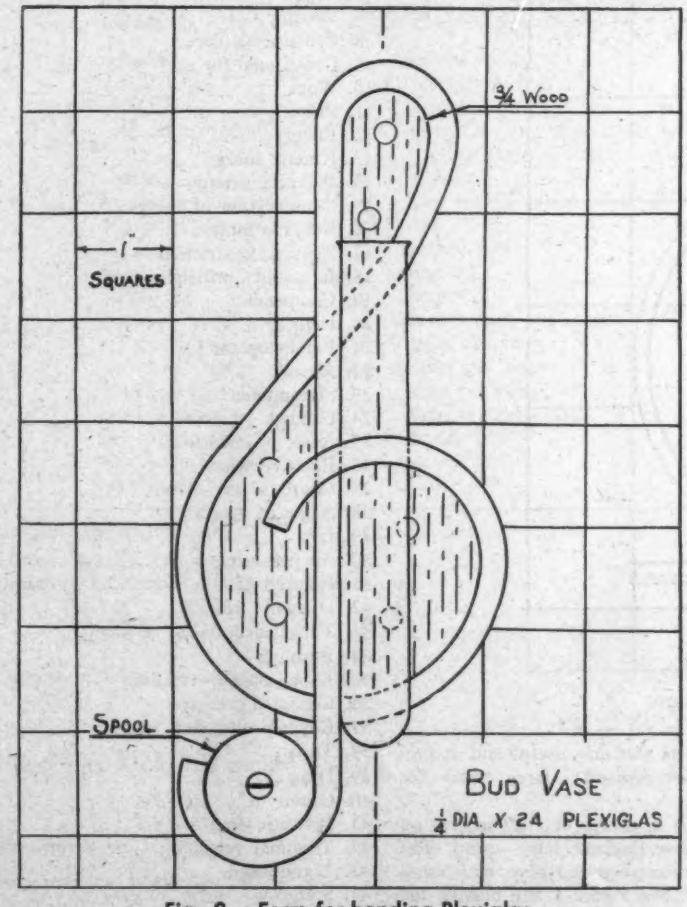

Fig. 2. Form for bending Plexiglas

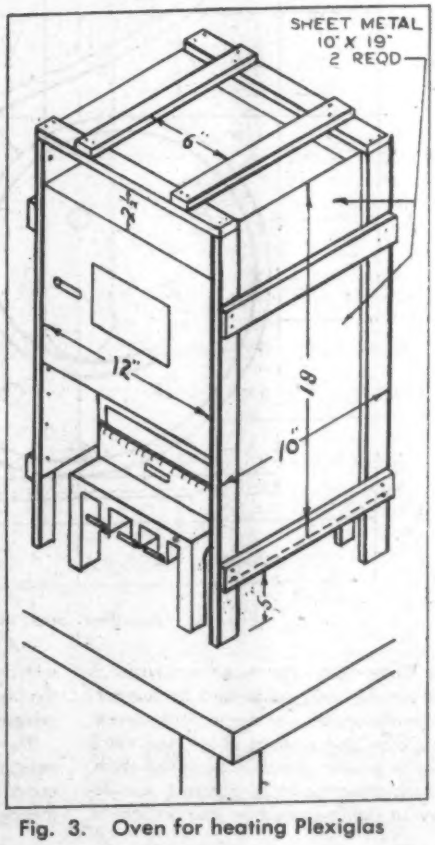

Fig. 3. Oven for heating Plexiglas

Section of shop exhibit

essary to redrill the ⅝-in. hole for the test tube. By inserting the test tube and standing the whole thing upright, it is possible to find the center, and mark it with a scratch awl. Holding plastic with a strip of wood over the edge of the drill-press table, drill hole for the works from an old electric clock, and fixed it to run. He then designed and made the case, and mounted the clock.

Other worth-while projects also may be tried out. The only drawback to many is the high cost of materials. This is overcome by selecting projects that are useful and attractive, yet do not demand a large outlay for materials.

The author is in charge of craftwork at an outstanding New England boys' camp. The camp colors are maroon and gray, with camp monogram CP. See Figure 1. By making the C in a dark red transparent plastic rod ¼ in. in diameter, and using the test tube for the upright in the center, a very neat project can be produced.

The projects just described may suggest others which may strike a spark of interest in someone, who, as yet, is not fortunate enough to have added plastics to his industrial-arts course.

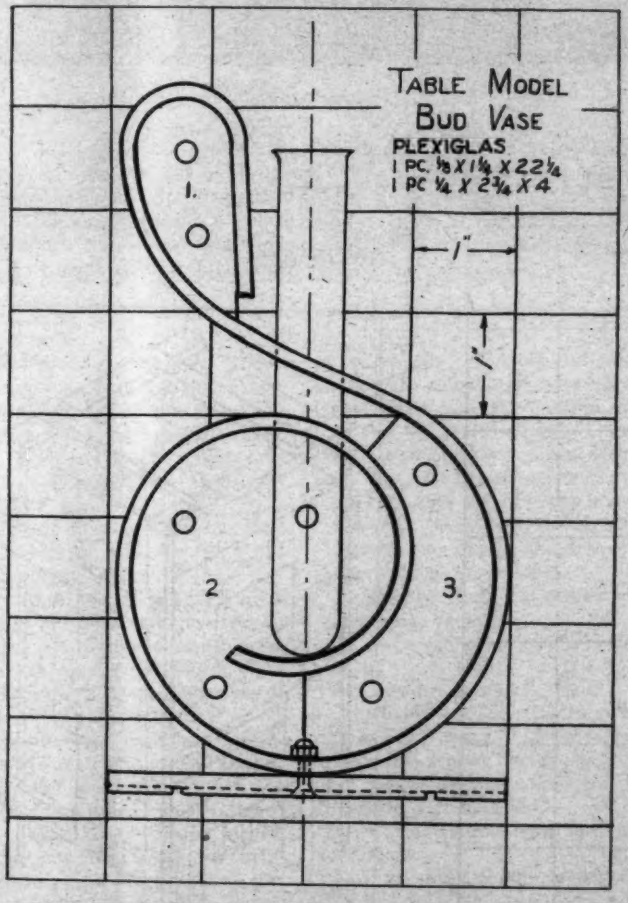

Fig. 4. Another bud vase design

flat-head stove bolt. The same size drill is also used for the base, which must be countersunk. Assemble upright to base with cap screw.

Necktie clips also appeal to boys, and much originality is usually shown in designing them.

The clock front shown in Figure 1 was designed by an eighth-grade boy who brought in

AERONAUTICS

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(Continued from page 217 of the May, 1947, issue)

UNIT V

Aerodynamics

Words or phrases to learn for this unit:

1. Newton's Laws of Motion
2. Acceleration
3. Mass
4. Velocity
5. Momentum
6. Impulse
7. Vectors
8. Centripetal force
9. Centrifugal force
10. Work
11. Power
12. Energy
13. Kinetic energy
14. Potential energy
15. Conservation of energy
16. Relative motion
17. Venturi constriction
18. Bernoulli's principle
19. Component
20. Density
21. Parallelogram law
22. Airfoil
23. Streamlines
24. Camber
25. Angle of incidence
26. Relative wind
27. Chord of an airfoil
28. Angle of attack
29. Lift
30. Air pressure
31. Induced lift
32. Dynamic lift
33. Turbulence
34. Burbling
35. Flying speed — stalling
36. Center of pressure
37. Reynold's number
38. Thrust
39. Drag
40. Gravity
41. Parasitic drag
42. Terminal velocity
43. Equilibrium
44. Stability

45. Damping tendency
46. Lateral stability
47. Longitudinal stability
48. Dihedral
49. Sweepback
50. Coefficient of drag
51. Coefficient of parasitic drag
52. Coefficient of lift
53. Aspect ratio
54. Horsepower
55. Slug

List giving meanings of the different letters used in the formulas with the unit of measurement they represent.

F	force	pounds; grams
M	mass	slugs
a	acceleration	feet per second per second
V	velocity	feet per second
V_o	original velocity	feet per second
t	time	second
g	gravity	32.2 feet per second per second
d	distance	feet
m	momentum	usually feet per second; or pounds per second
w	weight	pounds
r	radius of curvature	feet
π	pi	3.1416
d	diameter of circle	feet
C_1	coefficient of lift	term for lift characteristic of a wing at a given angle of attack
L	total lift	pounds
$\frac{rho}{2}$	air density	slugs per cubic foot
S	wing area	square feet
V	air velocity	feet per second
D	total drag	pounds
C_d	coefficient of drag	term for drag characteristic of a wing at a given angle of attack
W	weight	pounds
Min. V.	minimum flying speed	feet per second or miles per hour
a	equivalent flat plate area of the parasite	square feet
D_{par}	parasite drag	pounds
T	thrust	pounds
H.P.	horsepower	foot-pounds per second
A_o	air speed (old)	miles per hour
A_n	air speed (new)	miles per hour
rho_o	old air density	slugs per cubic foot
rho_n	new air density	slugs per cubic foot
S_o	old surface area (wing)	square feet
S_n	new surface area (wing)	square feet
P.A.	pivotal altitude	feet

Formulas used in this unit:

1. Force = mass × acceleration
2. Uniformly accelerated rectilinear motion =

$$a=\frac{V-V_o}{t} \text{ or } V=V_o+at$$

3. Distance traveled by accelerated motion

$$d=V_o t+\frac{1}{2}at^2$$

4. Distance for a body in a vacuum

$$d=\frac{1}{2}gt^2$$

5. Momentum =

$$m=\text{mass} \times \text{velocity}=MV=\frac{W}{g}V$$

6. Change in momentum

$$m=M(V-V_o)$$

7. Impulse

$$\text{Impulse}=\text{force} \times \text{time} \quad F=m\frac{(V-V_o)}{t}$$

when $F=Ma$ then $a=\frac{V-V_o}{t}$

8. Centripetal force

$$F=\frac{MV^2}{r}$$

9. Power = work ÷ time
10. Kinetic energy

$$KE=\frac{mV^2}{2}=\frac{\frac{1}{2}W}{g}V^2$$

11. Area of a circle

$$A=\frac{\pi d^2}{4}=\pi r^2$$

12. Coefficient of lift

$$C_L=\frac{L}{\frac{\rho}{2}SV^2}$$

13. Lift

$$L=C_L\frac{\rho}{2}SV^2$$

14. Coefficient of drag

$$C_o=\frac{D}{\frac{\rho}{2}SV^2}$$

15. Drag

$$D=C_o\frac{\rho}{2}SV^2$$

16. Possible weight

$$W=C_L\frac{\rho}{2}SV^2$$

17. Required wing area

$$S=\sqrt{\frac{W}{C_L\frac{\rho}{2}V^2}}$$

18. Required velocity

$$V=\sqrt{\frac{W}{C_L\frac{\rho}{2}S}}$$

19. Minimum flying speed

$$\min V=\sqrt{\frac{W}{\max C_L\frac{\rho}{2}S}}$$

20. Drag of a flat plate (coefficient of parasite drag)

$$F=1.28\frac{\rho}{2}aV^2$$

21. Parasite drag

$$D_{PAR}=1.28\frac{\rho}{2}aV^2$$

22. Total drag of a plan

$$D_{PLANE}=D_{WING}+D_{PAR}$$

23. Thrust

$$T=C_o\frac{\rho}{2}SV^2$$

24. Thrust

$$T=\frac{D}{L}W$$

25. Power

$$H.P.=\frac{TV}{550}$$

26. Required horsepower

$$H.P.=\frac{\left(C_o\frac{\rho}{2}SV^2\right)V}{550}$$

27. Horsepower for a given weight

$$H.P.=\frac{\left(\frac{D}{L}W\right)V}{550}$$

28. Horsepower for the parasite

$$H.P._{PAR}=\frac{1.28\frac{\rho}{2}aV^2}{550}$$

29. Total horsepower

$$H.P._{PLANE}=H.P._{WING}+H.P._{PAR}$$

30. Change of required air speed with density

$$A_n=\sqrt{\frac{\rho_o}{\rho_n}}A_o$$

31. Change of required horsepower with density

$$H.P._n=\sqrt{\frac{\rho_o}{\rho_n}}H.P._o$$

32. Change of required air speed with wing area

$$A_n = \sqrt{\frac{S}{S_n}}\, A_o$$

33. Change of required horsepower with wing area

$$H.P._n = \sqrt{\frac{S_n}{S_o}}\, H.P._o$$

34. Change of required air speed with weight

$$A_n = \sqrt{\frac{W_n}{W_o}}\, A_o$$

35. Change of required horsepower with weight

$$H.P._n = \frac{W_n}{W_o}\sqrt{\frac{W_o}{W_o}}\, H.P._o$$

36. Centripetal force needed for a turn

$$F = \frac{MV^2}{r}$$

37. Pivotal altitude

$$P.A. = .067A^2$$

38. Trigonometric functions

$$\sin a = \frac{\text{side opp.}}{\text{hypot.}};\quad \cos a = \frac{\text{side adj.}}{\text{hypot.}};$$

$$\tan a = \frac{\text{side opp.}}{\text{side adj.}}$$

I. Basic laws of physics involved in aeronautics

A. Newton's laws of motion

1. If a force acts on a body it remains at rest or continues to move with uniform velocity in a straight line.
2. If an unbalanced force acts upon a body, the body is given an acceleration in the direction of the force and the magnitude of the acceleration is directly proportional to the magnitude of the force and inversely proportional to the mass of the body.
   a) Must know that force is the cause of acceleration or the change in velocity.
   F = Mass × acceleration
   F (lb.) = M (slugs) × a (acceleration in ft./sec./sec.) *or*
   W (weight — the pull of gravity) = M (mass) × g (gravity)
   It is all right to change the formula if both W and g are changed for F and a, but neither term can stand alone.
3. Action and reaction are equal and opposite.

B. Other laws of motion that need to be learned (*Training Manual 1–233;* paragraphs 23, 24, 25, 26, 27, 28, 29)

1. Uniformly accelerated rectilinear motion

$$a = \frac{V - V_o}{t} \quad or \quad V = V_o + at$$

Vo is velocity at beginning
V is velocity at end of motion
a is the constant acceleration
t is the time of duration

a) Distance traveled by a uniformly accelerated motion

$$avgV = \frac{V_o + V}{2} \quad so \quad d = \frac{(V_o + V)t}{2} \quad or$$

$$d = \frac{(V_o + V + at)t}{2} \quad so \quad d = V_o t + \tfrac{1}{2} a t^2$$

b) Special case for a body in a vacuum. The pull of gravity is the only force acting so acceleration is g vertically downward.

$$d = \tfrac{1}{2} g t^2$$

c) If Vo = O (that is, if a body starts from rest and time is not known nor desired), then

$$V^2 = 2ad \quad or \quad V^2 = V_o^2 + 2ad$$

2. Momentum
   a) Momentum = mass × velocity *or*

$$\text{momentum} = \frac{\text{weight}}{\text{gravity}} \times \text{velocity}$$

   b) Change in momentum = M (mass) × ($V - V_o$)
3. Impulse (Newton's second law here applied)
   a) Impulse = force × time

   b. *Using* $F = Ma$ *and* $a = \frac{V - V_o}{t}$ *then*

$$F = \frac{M(V - V_o)}{t} \quad or \quad Ft = M(V - V_o)$$

4. Conservation of momentum (Newton's third law here applied)
   a) $M_1 V_1 + M_2 V_2 = m_1 V_1^1\ m_2 V_2^1$
   m = masses of two bodies
   V_1 and V_2 = respective velocities
   b) If forces and velocities are in various directions the rules of vector calculations are used and not the above rule.
5. Centripetal force (Newton's first law as applied to circular motion)

   a. $a = \frac{V^2}{r}$

V = speed, r = radius of curvature toward center,
a = acceleration

b. $F = Ma = M\frac{V^2}{r} \qquad F = \frac{MV^2}{r}$

When V = ft./sec., r = in ft.,

$$M = \frac{w \text{ (lb.)}}{g \text{ (32.17 ft./sec./sec.)}}$$

Then F = pounds

C. Work, Power, and Energy

1. Work is the exertion of force over a given distance.
   Work = force × distance
   a) A body may move but do no work as a stone swinging on a string.
   b) Work not only involves exertion of force but action as well — as a chair supporting a man but doing no work.
2. Power is work accomplished in a given time.

$$\text{Power} = \frac{\text{force} \times \text{distance}}{\text{time the force is taking}} \quad or$$

Force × Velocity = Power

3. Energy
   a) Potential energy — stored energy — arranged so that falling from a height an object may do work.
   P.E. = Force (or weight) × height (above a reference line)
   b) Kinetic energy is work done by imparting velocity to an object.

$$K.E. = \frac{MV^2}{2}$$

Where V^2 = velocity, M = mass, and KE = ergs or where W = weight, g = 32.2 ft./sec./sec., V = ft./sec., KE = ft./lb.

$$K.E. = \tfrac{1}{2}\frac{W}{g} V^2$$

4. Conservation of energy — total amount of energy in the universe remains constant.
   a) May be P.E. or K.E. or heat from friction.

D. Relative motion is useful because of wind tunnel tests being made possible by it.

1. Airplane wing moving 100 m.p.h. has the same qualities as an airplane wing standing still with a 100 m.p.h. wind blowing past it.

E. Fluids in motion

1. Velocity of fluids
   a) Venturi constriction
   b) $\text{Area}_1 \times \text{velocity}_1 = \text{area}_2 \times \text{velocity}_2$
2. Energies of fluids in motion
   a) Bernoulli's principle — **total energy** must remain constant.
   Energy due to height or position
   Energy due to pressure
   Energy due to movement

F. Vectors are measurements which have both magnitude and direction.

1. Addition of forces
   a) Two forces acting in the same direction and lines of action coincide, they may be added directly.
   1) Man running on a train of flat cars as an example
   b) Two forces acting along same line but smaller from the larger
   1) Man on a treadmill as an example
   c) When two forces act on a point but their lines of action are not identical, do the following:

Scale the diagonal for the answer.

The direction is found by using a protractor.

2. Addition of velocities
   a) Velocities are vectors and may be added the same as forces.
3. Components — when two forces or velocities are added to give a resultant. Each force making up the resultant is said to be a component force of that resultant. There can be an infinite number of components for the same resultant.

II. Units of measure

A. Fundamental units
1. Unit of length — centimeter (from 1/100 of a meter which was to be 1/10,000,000 of the distance from the equator to the pole along a meridian):
   a) Millimeter, mm., 1/1000 meter
   Centimeter, cm., 1/100 meter
   Decimeter, dm., 1/10 meter
   Kilometer, km., 1000 meters
   b) area = length × width
   volume = length × width × height
   volume = capacity to hold (as one liter equals 1000 cubic centimeters)
2. Mass — unit is the gram (from one cubic decimeter of platinum at 40° centigrade):
   milligram, mg., 1/1000 gram
   gram, g. or gm., basic unit of measure
   centigram, cg. 1/100 gram
   decigram, dg. 1/10 gram
   kilogram, kg., 1000 grams
3. Time — based on mean solar second — or 1/86,400 part of a mean solar day — same in all systems — is the earth's rotation around its axis.

B. Derived units of measure
1. Density is the mass of weight per unit of volume.
   a) Water — as grams per cubic centimeter. The density of water at 4° centigrade is one gram per cubic centimeter.
   b) Air — density is .00129 grams per cubic centimeter at 0° centigrade and 76 centimeters of mercury.
2. Velocity is the distance traveled per unit of time. May be centimeter per second; mile per hour; or feet per second.
3. Acceleration is the rate of increase or decrease of velocity.

III. Scalar and vector quantities

A. Both direction and magnitude must be defined for a vector quantity.
1. Velocity is a quantity as 300 miles per hour, north–northeast.
2. Speed is not a quantity as 300 miles per hour.
3. Force, acceleration, velocity, and momentum are vector quantities.
4. Scalars are specified by magnitude only as temperature, volume, energy, mass, time, and power.

B. Addition of vectors
1. Parallelogram law — the resultant of two vectors is represented in direction and in magnitude by a diagonal of a parallelogram whose sides represent magnitudes and directions of two vectors.
2. Triangle law — where vectors are given and the resultant is the third or closing side of a triangle.
3. Polygon law — states that the sum of several vectors is a vector required to close the polygon partially formed by laying off several vectors in succession.
4. Components of vectors
   a) Graphical method already explained
   b) Mathematical or trigonometrical method
   1) Always a right triangle then the following ratios apply

$$\sin \alpha = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \alpha = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \alpha = \frac{\text{side opposite}}{\text{side adjacent}}$$

$$\cot \alpha = \frac{\text{side adjacent}}{\text{side opposite}}$$

$$\sec \alpha = \frac{\text{hypotenuse}}{\text{side adjacent}}$$

$$\csc \alpha = \frac{\text{hypotenuse}}{\text{side opposite}}$$

TM 1–233 is an excellent source for problems here.

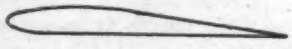
IV. Air flow about a wing

A. Airfoils and streamlines
1. An airfoil is any structure around which air flows in a manner useful to flight.
   a) Wings, propeller, tail surfaces, and fuselage

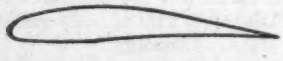
B. Streamlines are paths of air particles as they flow past an object.
1. As the speed of the air increases the streamlines are drawn farther apart so as to leave a wide space behind the object. This is separation.
2. The air from the nearest streamlines burble into this space causing increased resistance.

C. Three types of airfoil sections:
1. Double convex

2. Convex upper surface — straight lower surface



3. Convex upper surface — concave lower surface



D. The chord of an airfoil is the projection of the airfoil on the direction line. It shows both length and direction.

E. The camber of an airfoil is the curvature of the surfaces of an airfoil. The mean camber is the median of curvature.

F. The angle of incidence is that angle the chord of the airfoil makes with a line parallel to the longitudinal axis of the plane.

G. Relative wind — the direction of the air relative to the plane — in horizontal flying the wind is horizontal; in a glide the wind is slightly upward.

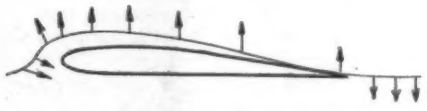
H. Angle of attack is that angle the chord of the airfoil makes with the relative wind.

I. Air pressure
1. About .077 per pound weight.
2. One square inch weighs 14.7 pounds.
3. Presses equally in all directions — both top and bottom as well as on the sides.

J. Lift — underside of an airfoil has a greater air pressure than the upper side and this difference in pressure produces lift. *All lift comes from below the wing.*

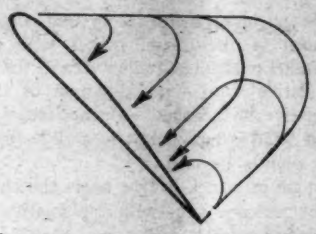
K. Bernoulli's law as applied to airfoils
1. Lift at zero angle of attack is due to the curvature of the upper wing surface which in turn causes a reduced pressure on the top of the airfoil.
   a) Not true in the case of a symmetrical airfoil.
2. Bernoulli's law as applied to airfoils is that in air streams, the greater the speed of the air the less the pressure of the air, and the less speed of the air the greater the pressure.
3. This law is best illustrated with a Venturi tube. Simpler experiments for individual student use are:
   a) Folding paper and blowing over the top
   b) Cardboard and a spool
   c) Atomizer
   d) Boats in water
   e) Vibrating cards

L. Effect of centrifugal force on an airfoil
1. Newton's laws of motion should be reviewed before any discussion.
2. From the accompanying diagram the effect of centrifugal force is easily seen.



3. The lift caused by reduced pressure of the air is called induced lift.

M. Total lift
1. Dynamic lift is caused by impact of the air on the underside of the airfoil surface at a positive angle of attack.
2. The negative angle of attack at which there is no lift is called the "no-lift angle of attack."
3. The absolute angle of attack is any angle the airfoil makes in an upward turn from the "no-lift" position.
4. Burbling is the name given to the turbulence of the air stream in the section illustrated. The cause is that too great an angle of attack causes the centrifugal force to not permit the air to reverse its motion enough to flow down along the airfoil.
5. Stalling is the result of too little speed



for the angle of attack and burbling results which causes a stall.

a) The action of losing lift is self-generating. Burbling causes stall, the tail sinks which increases the angle of attack which causes more burbling, etc.

b) Flying speed is the minimum speed at which the causes leading to burbling are not present.

c) Stalling or "squashing" at high speed is possible even though the nose is held high — the angle of attack is too great.

6. The center of pressure (CP) for an airfoil section only is that point where all forces are combined into a resultant force.

a) The center of pressure travels with a change in the angle of attack. This causes an inherent quality of instability.

b) Force is never perpendicular acting to the section due to the viscosity of the air.

1) Reynold's number — the density of the air divided by the viscosity of the air times the chord in feet times the velocity in feet/sec.

Physical Science in the Air Age is particularly adaptable for problems here (pp. 47–48).

V. Forces acting on a plane

A. Based upon Newton's first law of motion concerning equilibrium and a body at rest or moving at a uniform rate.

1. Plane on the ground — gravity pulls to center of the earth — the earth resists with an equal force upward.

B. The amount and direction of a force may be represented by a vector.

C. The whole plane has a combined effect of all aerodynamic forces. This is called the total resultant aerodynamic force and this force affords the lift on the airplane.

D. There are four major forces acting on a plane in flight:

1. Lift — resultant aerodynamic force on the wing
2. Thrust — puli of the propeller
3. Gravity
4. Drag — any force resisting forward motion

a) Parasite drag — portion of force other than that of the wings

E. Forces acting on a climbing plane

F. Forces acting on a plane in a glide

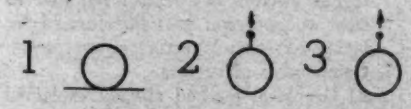
G. The terminal velocity of a plane is the maximum speed in a vertical dive.

H. The plane goes into a spin when forces are not in equilibrium.

VI. Axes of stability and controls for each

A. Three classes of stability:

1. Neutral as a ball on a table
2. Stable
3. Unstable



B. Damping tendency is a slowing down of oscillations of the plane. It is the restoring tendency of normal flight.

C. Longitudinal stability is exhibited about the pitching axis (pitch).

1. Controlled by stabilizer and the elevators
2. Elevator tabs

D. Lateral stability is exhibited about the rolling axis (roll).

1. Control is based upon dihedral, keel effect, sweepback, proper distribution of weight.

a) Dihedral helps keep banked position stable.

b) Keel effect causes body of the plane to go down first instead of wings or tail — as an umbrella with a brick tied to the handle.

c) In rolling sideslip the leading edge will be presented perpendicular to the relative wind with sweepback — very seldom used due to stalling tendency.

d) Ailerons, effective control at high speeds.

E. Directional stability is exhibited when a plane blown temporarily off course tends to return to its original direction of flight (yaw).

1. Control is mainly based on the fin and rudder.
2. Sweepback of the wing helps some by causing the wing not presented perpendicular to the relative wind to speed up and this turns the plane.
3. Keel effect in yawing is dangerous and apt to cause spins but be sure the center of lateral pressure is just a little behind the center of gravity for best results.

VII. Lift and drag

A. Lift varies directly in proportion to the wing area.

B. Lift varies directly as the square of the velocity of the air:

air speed = .682 V
velocity = 1.467 A
V = feet/sec.
A = miles per hour

C. Drag varies directly in proportion to the wing area.

D. Drag varies directly as the square of the velocity of the air.

E. Lift varies with air density.

1. Density — unit of mass per cubic foot
2. Mass is a quantity.
3. Slug is a term used for a mass of air approximately 32.2 pounds.
4. Density of air is .002378 slugs per cubic foot at 59° F. at sea level.
5. Density of the air becomes less at higher altitudes.

F. Drag varies with air density

G. Lift varies directly (increases) with the angle of attack.

H. Drag varies indirectly with the angle of attack.

I. Coefficients of lift and drag (C_L and C_D).

1. Coefficient of lift for a given wing shape at a given angle of attack is the number of pounds of lift of a wing of that shape with unit area, at unit air velocity, and in air at one-half unit density:

L = total lift, S = wing surface, V = velocity, $\frac{\text{rho}}{2}$ = one half the number of slugs per cubic foot.

$$C_L = \frac{L}{\frac{\rho}{2} S V^2}$$

2. Coefficient of drag is the drag of a wing at a given angle of attack in terms of the number of pounds of drag on a similar wing of unit area at unit air velocity and in air at one-half unit density.

$$C_D = \frac{D}{\frac{\rho}{2} S V^2}$$

J. Coefficient of parasite drag — same as the resistance of flat plate area to air flow

1. The parasite drag varies as the square of the velocity: F = force (drag), a = area of plate, V = velocity in ft./sec., $\frac{\text{rho}}{2}$ = density of air

$$F = 128 \frac{\rho}{2} a V^2$$

2. Need to know equivalent flat area of the parasite to apply the above formula.
3. Total drag is equal to wing drag plus the parasite drag.
4. The thrust must equal the total drag if the plane is in equilibrium.
5. Ratio of parasite drag to wing drag is less at high angles of attack.

K. The aspect ratio is the ratio of the span to its mean chord. To avoid loss of lift due to wing tip vortices the ratio should be as great as possible.

1. Airplanes have a ratio of about 6–1 or 8–1 and gliders are as high as 20–1.
2. Usually C_L and C_D are computed for ratio of 6–1; however, at 8–1 the lift is about 6 per cent greater and the drag is about 15 per cent less.

VIII. Speed and power

A. Velocity — formula for required velocity — the lift and the weight have to be equal to keep the plane in equilibrium

$$L = C_L \frac{\rho}{2} S V^2 = \text{weight}$$

$$V^2 = \frac{W}{C_L \frac{\rho}{2} S} \quad \text{or} \quad V = \sqrt{\frac{W}{C_L \frac{\rho}{2} S}}$$

1. High air speed at low angles of attack until 18 deg. is reached where least velocity is needed.

B. Formula for minimum velocity or the slowest landing speed.

(Continued on page 18A)

FREE! TO INDUSTRIAL ARTS TEACHERS

HOW-TO-DO-IT BOOKS on Aluminum Shop Practices

FORMING ALCOA ALUMINUM AND MAGNESIUM
1947; 56 pages; 20 Illustrations

Explains the fabrication of aluminum and magnesium by blanking and piercing, drawing, spinning, shape forming, embossing, coining and stamping. Discusses the forming characteristics of the various aluminum and magnesium alloys.

ALCOA ALUMINUM AND ITS ALLOYS
1947; 180 pages; 25 Illustrations; 88 tables

Fundamental information concerning the many Alcoa Aluminum Alloys. Data in tabular form on their chemical and physical properties as well as the tolerances and sizes of all commercial forms.

RIVETING ALCOA ALUMINUM
1947; 48 pages; 12 Illustrations

Detailed information on riveting aluminum and its alloys. Covers strength and proportions of riveted joints, driving methods, and selection of rivet alloy. Also, brief account of aircraft riveting.

MACHINING CHART
14 x 20 inches

Describes proper rake angles for machining aluminum, correct tool material, best cutting speeds and feeds, and types of cutting compounds. Illustrations show types and uses of numerous tools used in machining aluminum.

FINISHES FOR ALCOA ALUMINUM
1947; 64 pages; 60 Illustrations

A handbook which discusses the many kinds of finishes that can be applied to aluminum by mechanical, organic, chemical, electrochemical, and electroplating methods. 4-color plates show actual finishes.

WELDING AND BRAZING ALCOA ALUMINUM
1947; 120 pages; 49 Illustrations

Complete information on torch, arc, resistance welding, and brazing of aluminum. Six full-color illustrations of welding flame adjustments.

CASTING ALCOA ALLOYS
1947; 130 pages; 29 Illustrations

General foundry principles, including melting, molding, and finishing. A complete description of the various aluminum casting alloys is listed in convenient forms.

WELDING AND BRAZING CHART
10¾ x 13¾ inches

Contains helpful information for welding and brazing aluminum, including proper flame adjustments for both oxyhydrogen and oxyacetylene. Well illustrated and printed in full color, both sides.

Which of these books and visual aids do you need? They will prove invaluable to any teacher whose students are working with aluminum. Below is additional material, useful for general background information on aluminum. All teaching aids described on this page sent free to industrial arts teachers. Write ALUMINUM COMPANY OF AMERICA, 1773 Gulf Building, Pittsburgh 19, Pennsylvania.

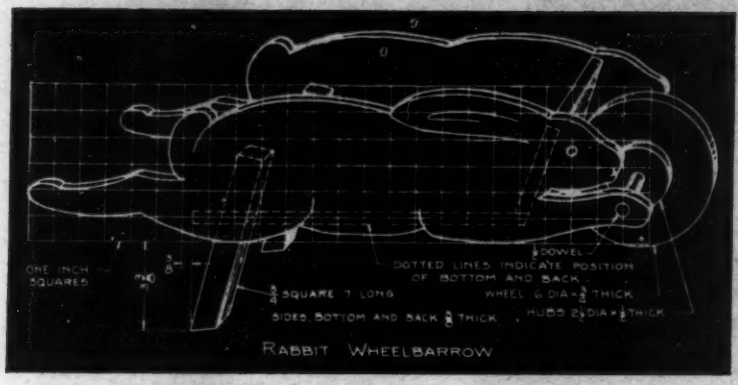
ALUMINUM—ITS STORY
Written in nontechnical style for Junior High School students. Tells how aluminum is made, its history and uses. 48 pages, illustrated.

AN OUTLINE OF ALUMINUM
General information on the history, chemistry, production, and applications of aluminum. Suitable for teachers and Senior High School students. 64 pages, illustrated.

CHART ON CHEMISTRY AND HISTORY OF ALUMINUM
Covers complete story of aluminum from mine to metal. Graphically illustrated with photographs, diagrams, drawings, and raw material samples. 21 x 30 inches.

ALCOA FIRST IN ALUMINUM

MAKE YOUR CLASSROOM SANTA'S WORKSHOP


ONE-INCH SQUARES
DOWEL
DOTTED LINES INDICATE POSITION OF BOTTOM AND BACK
WHEEL 6 DIA. x ¾ THICK
¾ SQUARE 7 LONG
SIDES, BOTTOM AND BACK ⅜ THICK
HUBS 2½ DIA. x ¾ THICK
RABBIT WHEELBARROW

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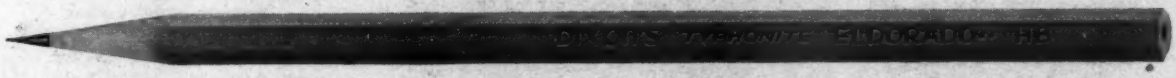


SCHOOL BUREAU, PENCIL SALES DEPT., 128-J11, JOSEPH DIXON CRUCIBLE CO., JERSEY CITY 3, N. J.

(Continued from page 396)

$$Min.V=\sqrt{\frac{W}{Max.C_L\frac{\rho}{2}S}}$$

C. The thrust is equal to the drag; so the thrust of the wing equals the drag of the

$$T_w=C_D\frac{\rho}{2}SV^2$$

wing, and the thrust for the parasite equals

$$T_{PAR}=128\frac{\rho}{2}aV^2$$

parasite drag; and the total thrust is

$$T_{TOTAL}=T_W+T_{PAR}$$

D. The relation of thrust to weight

$Lift=C_L\frac{\rho}{2}SV^2$ $\quad weight=lift$

and

$Drag=C_D\frac{\rho}{2}SV^2$ $\quad thrust=drag$

so

$$\frac{Thrust}{Weight}=\frac{drag}{lift}=\frac{C_D\frac{\rho}{2}SV^2}{C_L\frac{\rho}{2}SV^2}=\frac{C_D}{C_L}$$

therefore

$$Thrust=\frac{drag}{lift}xWeight=\frac{D}{L}W \text{ and } T=\frac{C_D}{C_L}W$$

therefore $\frac{C_D}{C_L}=\frac{D}{L}$

E. Power

1. The rate of work in foot-pounds per second is equal to the thrust times the velocity. Rate of work = T × V
2. *a*) Horsepower (550 ft./lb./sec. = 1 h.p.)

$$H.P.=\frac{TV}{550} \qquad V=\text{ft. per sec.}$$

b) Horsepower for a wing

$$H.P.=\frac{TV}{550}=\frac{(C_D\frac{\rho}{2}SV^2)V}{550}=\frac{C_D\frac{\rho}{2}SV^3}{550}$$

c) Horsepower for parasite drag

$$H.P.=\frac{TV}{550}=\frac{(128\frac{\rho}{2}aV^2)V}{550}=\frac{128\frac{\rho}{2}aV^3}{550}$$

d) Horsepower from weight and velocity

$$H.P.=\frac{TV}{550}=\frac{(D_2W)V}{550}$$

e) Horsepower for airplane

$$H.P._{PLANE}=H.P._{WING}+H.P._{PAR}$$

$$H.P._{TOTAL}=\frac{(D_2W)V}{550}+\frac{128\frac{\rho}{2}aV^3}{550}$$

As the angle of attack increases the total horsepower decreases.

IX. Airplane performance

A. Effect of altitude — the velocity varies inversely with the square root of the density at the same angle of attack. A_n = new air speed
V_n = new velocity at new density
A_o = old air speed
V_o = old velocity
rho_o = old density
rho_n = new density

$$V_n=\sqrt{\frac{\rho_o}{\rho_n}}V_o \qquad A_n=\sqrt{\frac{\rho_o}{\rho_n}}A_o$$

1. The higher we go the less dense the air and the greater the velocity needed to sustain the plane at the same angle of attack (need more horsepower for this, however)
2. Warm air is less dense than cold air and more flying speed is needed on warm days.

B. The horsepower needed for altitude varies inversely as the square root just as air speed does.

$$H.P._n=\sqrt{\frac{\rho_o}{\rho_n}}H.P._o$$

C. Effect of change of wing area upon the required velocity is such that velocity and horsepower vary inversely as the square root of the new wing area to the old wing area (S_o = old area, S_n = new wing area).

$$A_n=\sqrt{\frac{S_o}{S_n}}A_o \text{ and } HP_n=\sqrt{\frac{S_o}{S_n}}H.P._o$$

D. The air speed necessary to sustain a plane varies directly with the square root of the weight.

$$A_n=\sqrt{\frac{W_n}{W_o}}A_o$$

1. The horsepower varies directly as the weight times the square root of the weight.

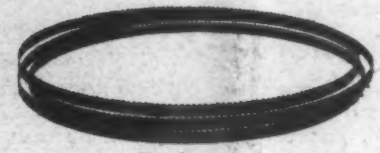
$$H.P._n=\sqrt{\frac{W_n}{W_o}}\frac{W_n}{W_o}H.P._o$$

a) The number of pounds of weight of a plane per square foot of wing area is the wing loading of the plane as a

(Continued on page 20A)

Hand Saws

DeLuxe Circular Saws



Band Saws

Back Saws

Hack Saw Frames and Blades

Coping Saws

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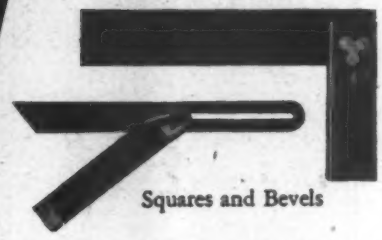

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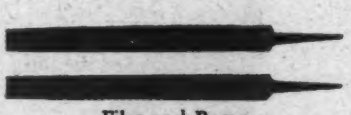

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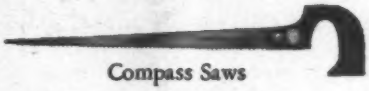

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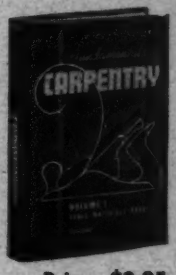

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3. **MASONRY SIMPLIFIED,** Volume II, Practical Construction. Townsend–Dalzell. Ready January 1, 1948.
4. **THE RAILWAY FOREMAN AND HIS JOB,** Christie–McKinney. Just Published. $3.50
5. **HOW TO READ FOR SELF-IMPROVEMENT.** Levin. Just Published. $2.75

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(Continued from page 18A)

2500 pound load and an area of 200 square feet has a 12.5 wing load (W/S).

b) The velocity of a plane necessary to sustain the weight

$$V = \sqrt{\frac{W}{C_L \rho S}} \text{ or } \sqrt{\frac{W/S}{C_L \frac{\rho}{2}}}$$

c) Formula by combining the change in velocity and area

$$V_n = \sqrt{\frac{W_{Sn}}{W_{So}}}\, V_o \text{ and } A_n = \sqrt{\frac{W_{Sn}}{W_{So}}}\, A_o$$

d) Cannot double area and weight without doubling the horsepower

E. Propeller

1. The propeller is an airfoil though very complex. It has a leading edge and a trailing edge same as a wing.
   a) Each blade element has a blade angle; this is due to the twist.
      1) Blade angle is the angle that the chord of the blade element makes with a plane perpendicular to the propeller shaft.
   b) The pitch is the distance the propeller moves forward during one full revolution when the nominal blade element (¾ of the distance from axis to tip) is at zero angle of attack.
   c) Propeller turns at a rate in relation to air speed to always have a slightly positive angle of attack. Therefore, the forward movement of the propeller axis is less than the nominal pitch and is called the effective pitch.
   d) This lag (difference between nominal and effective pitch) is called the slip of the propeller.
   e) Angles of attack for a propeller
      1) Varies as the L/D ratio
      2) Constructed so that it fits the horsepower of the engine and most efficient angle of attack
      3) Can either be constructed for climb or for level flight for a stationary propeller. That is where a variable pitch propeller is necessary.

X. Circling and climbing

A. The horsepower that is required is less than that available. This difference can be used for climbing.

B. Flying a curve

1. Centripetal force needed for a turn is:

$$F = \frac{\text{Mass} \times \text{Velocity}^2}{\text{Radius}}$$

Use this formula to find the force, then use the parallelogram law and the resultant is the lift and the angle is the angle of bank.

2. Use the parallelogram law to find additional lift for a given angle of attack.
3. To find the pivotal altitude for an onpylon turn:

P.A. = .067 A^2

PA = pivotal altitude

A = air speed in miles/hour *or*

a) Find mass in slugs

b) Then find $F = \frac{MV^2}{r}$

c) Then use the parallelogram law

In the outline there are notations that suggest likely places for supplementary problems (with their source listed) besides the regular problems given in the class text *Elements of Aeronautics* by Pope and Otis. These books are to be used for problem assignments:

1. Pope and Otis, *Elements of Aeronautics*
2. Jones, *Aerodynamics for Pilots* (CAA No. 26)
3. TM 1–233, *Elementary Physics for Air Crew Trainees.*

Personal News

L. OMER ASHER RETIRES

After spending 44 years in the field of education, L. Omer Asher, supervisor of industrial arts of the school system at Orange, N. J., retired at the end of the school year 1946–47.

Mr. Asher is a graduate of Indiana State Normal School and took additional work at Bradley Polytechnic Institute, Columbia University, and Rutgers University.

Before coming to Orange, he taught at Rah-

(Continued on page 23A)

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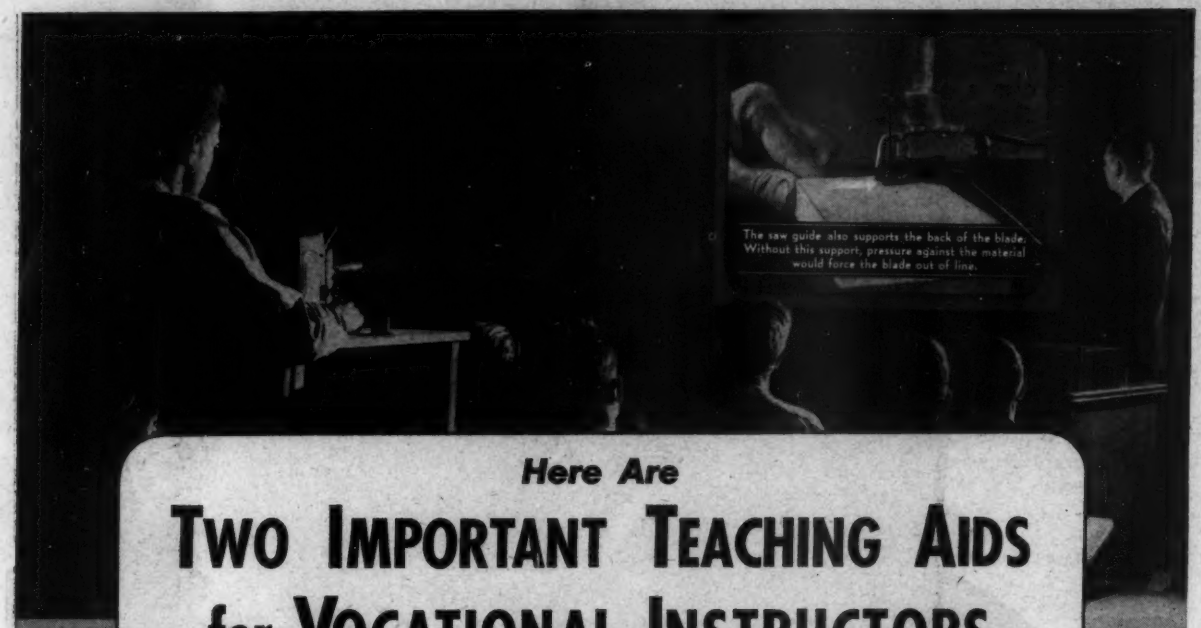
The saw guide also supports the back of the blade. Without this support, pressure against the material would force the blade out of line.

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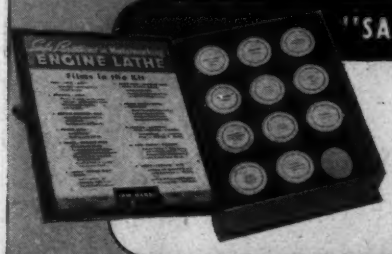
TWO IMPORTANT TEACHING AIDS for VOCATIONAL INSTRUCTORS



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(Continued from page 20A)

way, N. J., and at Altoona, Pa. He spent 36 years as teacher and supervisor at Orange.

He is a charter member of Nu Chapter of the Epsilon Pi Tau fraternity. He has served as president of the School Crafts Club of New York City, New Jersey Vocational and Arts Association, the Orange Teachers' Association, and the Epsilon Pi Tau fraternity.

A testimonial luncheon attended by 50 of his

L. Omer Asher

co-workers in education was tendered him on June 12, 1947, at which time an endorsed testimonial and gift were presented to him. Later in the day, the teachers from his own department gave a special party at which they presented him with a farewell gift.

♦ Dr. Walter B. Jones, Department of Vocational Education, University of Pennsylvania, Philadelphia, takes a year's leave of absence (school year 1947–48) to serve as consultant in teacher education in Brazil.

He will work under auspices of the Institute of Inter-American Affairs, an agency of the department of state. He may be addressed in care of the American Embassy in Rio de Janiero, Brazil, South America.

♦ Robert S. McDowell has been appointed assistant state supervisor of trade and industrial education, state of West Virginia.

Mr. McDowell completed his graduate work at New York University on the degree of M.A. in vocational education. He served with the Occupation Forces in Japan, as an interpreter, and was in charge of all Japanese vocational education under SCAP.

♦ John W. Curd has been appointed specialist in trade and industrial education at the University of Texas. His assignment includes the preparation of instructional material for the various trade and industrial vocational classes of Texas as well as sponsoring a newly formed vocational-industrial club of Texas for day trade vocational students in industrial education.

Association News

♦ The New England Industrial Arts Teachers' Association will hold its tenth annual convention at the Hotel Bond in Hartford, Conn., November 7 and 8, 1947.

Chief speakers will be Dr. Alonzo V. Grace, commissioner of education, Hartford, Conn., and Dr. Dean M. Schweickhard, commissioner of education, St. Paul, Minn. Chairman of the convention committee is Walter McAndrews, director of industrial arts, Hartford, Conn. The program will include visits to shops, schools, and industries, round-table discussions, work demonstrations, a large commercial exhibit, talks on pertinent subjects, and a business meeting involving changes in the constitution and bylaws.

The officers of the association are Harold K. Anderson, president, Cranston, R. I.; Walter F. McAndrews, vice-president, Hartford, Conn.; Percy F. Marsaw, secretary, Worcester, Mass.; and Charles Allen, treasurer, Portland, Me.

The state chairmen are: Maine, Kenneth Webber, South Portland; New Hampshire, Paul W. Nutter, Conway; Vermont, Ralph H. Burgess, Brattleboro; Massachusetts, Irving A. Dodge, Lexington; Rhode Island, William E. Sloane, Providence; Connecticut, Ralph E. Duso, Fairfield. — *Percy F. Marsaw*, secretary.

♦ The Texas Vocational Teachers Association elected the following officers for the current year: president, Wade Banowsky; vice-presidents, Harriet Griffin, (Guidance); Vannoy Stewart, (Veterans' Education); Clarence Rabb, (Agriculture); and C. H. Groneman (at large).

♦ The 1947 convention of the American Vocational Association will be held at the Hotel Biltmore, Los Angeles, December 15–18.

♦ The installation of Omega Chapter of Epsilon Pi Tau, international honor society in industrial arts and industrial-vocational education, took place on May 10, 1947, at the Student Union Building at the Nebraska State Teachers College, Wayne, Neb.

The institution team consisted of Alvin Wutti, Theta Chapter, Menomonie, Wis.; Ralph D. Sellhorn, Eta Chapter, Peru, Neb.; Lawrence Wright, Theta Chapter, Menomonie, Wis.; Carlton Erickson, Theta Chapter, Menomonie, Wis.; Ward Cowles, Theta Chapter, Menomonie, Wis.; William E. Warner, Alpha Chapter, Columbus, Ohio;

(Continued on page 26A)

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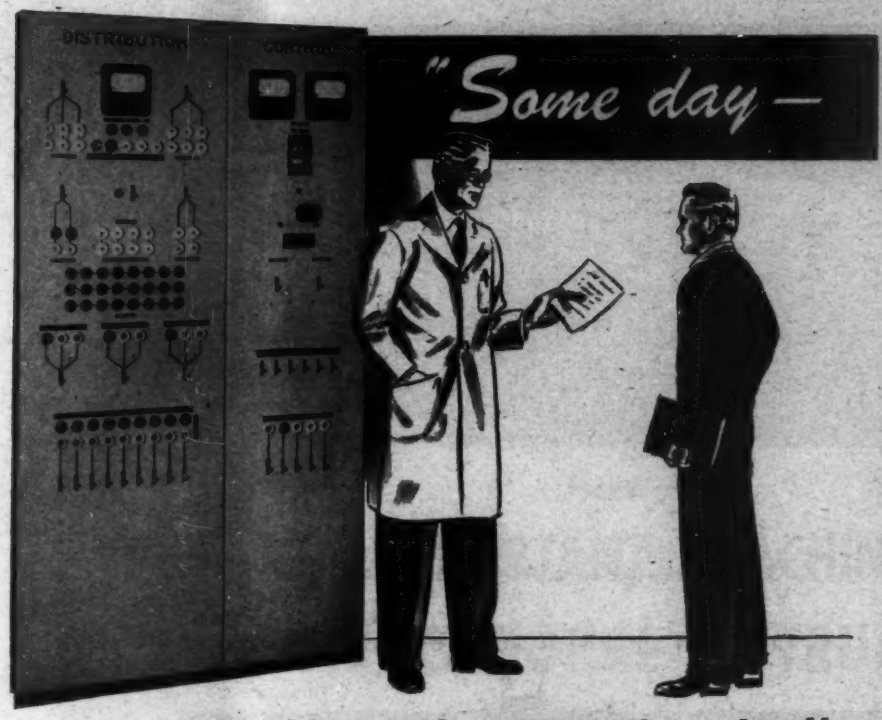

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Questions and Answers

PLANS FOR MAKING WOODWORKING POWER TOOLS

1119. Q.: I saw plans of a spindle sander in your magazine and was wondering whether you could tell me where to find plans for other woodworking tools. — *C. K.*

A.: The following list of back issues of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine contain articles on woodworking tools:

October, 1939 — Homemade Shaper and Spindle Sander
December, 1939 — 18-in. Twin-Disk Sander
January, 1940 — 18-in. Twin Disk Sander
September and October, 1941 — Column-Type Drill Press
November, 1941 — Jig-Saw Details
January, 1942 — Jig-Saw Details
February, 1942 — Jig-Saw Details
April and May, 1942 — Universal Milling Machine
September, 1945 — Home Workshop Grinder
December, 1945 — Ten-Inch Bench Saw
December, 1946 — Oscillating Spindle Sander

Lewis Machine Tool Co., P.O. Box 7446, Sta. L, Dept. X, Los Angeles 23, Calif., furnishes rough or semifinished castings for making a number of power machine projects. — *J. J. M.*

A SALAD BOWL FINISH

1120. Q.: How can I finish the inside of birchwood salad bowls so that they are not affected by vinegar or other salad ingredients, and that they in turn will not affect the food. — *S. T.*

A.: After the bowls are sanded smoothly, stain as desired with water soluble stains. Allow at least four hours for drying at room temperature. Apply a coat of well-stirred Du Pont's Penetrating Wood Finish. Allow this to set for thirty minutes, rag it off, and allow it to dry overnight. Rub off with 2/0 steel wool, dust, and recoat with the Penetrating Wood Finish. Allow this coat to set for 15 minutes, rag off, and rub with a pad of 2/0 steel wool into which a tablespoon of floor wax has been folded. Then polish dry with a clean, cotton flannel cloth pad.

This finish is permanent, can be washed with soap and water, is not affected by grease, and can be renewed from time to time with a fresh coat of wax. — *J. J. M.*

New Publications

Getting the Most Out of Your Band Saw and Scroll Saw

Edited by Sam Brown. Paper, 48 pp., 6 by 8⅜ in., illus., 25 cents. Delta Manufacturing Division, Rockwell Manufacturing Co., Milwaukee, Wis.

This is the sixteenth edition of this useful booklet for students and homecrafters who own or have access to power band saws and scroll saws. It describes in simple terms the construction, method of installation, and power and speeds of these two types of power saws. It tells also what kinds of saw blades to use for the different types of work performed, and how to care for these blades. It also shows how these saws may be used for cutting metal, plastics, paper, and cloth, and how to use the scroll saw for filing and sanding.

Organizing and Teaching the General Shop

By Louis V. Newkirk. Cloth, 200 pp., 7 by 9¾ in., illus., $4. The Manual Arts Press, Peoria, Ill.

The author who has had much experience with organizing and supervising general shops, presents in this book the concept underlying the general shop, the objectives and activity content of the general shop, how to plan the general shop, how to organize it, and how to prepare tests for the general shop.

The book also contains interesting projects, and a very rich bibliography.

A Brief Course in Strength of Materials

By George P. Bischof. Paper, 93 pp., 5½ by 8 in., illus., $1.95. Prentice-Hall, Inc., New York, N. Y.

A book for technical high school students, explaining simple and compound stresses and their application in joints of various kinds, and in beams, columns, and shafts.

The book contains numerous problems and useful tables. It also contains the answers to the problems presented.

Aircraft Welding

By Col. R. H. Drake. Cloth, 254 pp., 6¼ by 9¼ in., illus., $4. The Macmillan Co., New York, N. Y.

This book, while it contains all the essential information required to acquire an aircraft mechanic's license, is equally useful to learners and journeymen welders who are engaged in other than aircraft welding.

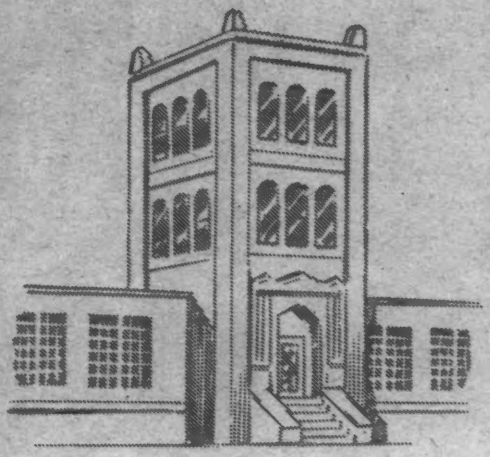
It contains a glossary of terms used in aircraft welding, and a wealth of information, simply explained and well illustrated on the welding equipment and welding practices used by those working in the welding field.

General Plastics

By Raymond Cherry. Paper, 156 pp., 7¾ by 10¼ in., illus., $1. McKnight & McKnight, Bloomington, Ill.

This is the second edition of this helpful book

(Continued on page 26A)



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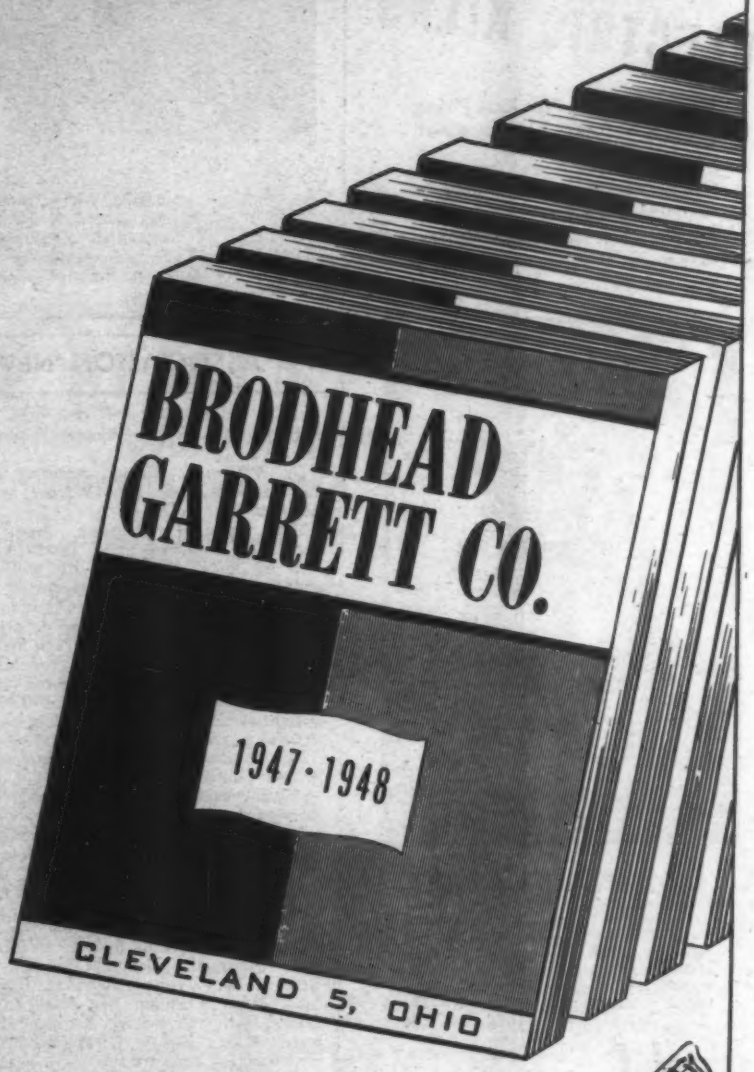

The new Brodhead Garrett Catalog is ready to serve you again in 1947-48. This year's catalog contains many new items and revised specifications on others — but still the most complete line of Industrial Arts and Vocational Supplies ever prepared. The Brodhead Garrett catalog is your yardstick for discriminating buying. It will save the school budget many actual dollars . . . and assure your school the best in equipment and supplies.

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ASSOCIATION NEWS

(Continued from page 23A)

and Arthur G. Brown, Theta Chapter, Menomonie, Wis.

Dr. William E. Warner, executive secretary of the fraternity, and Mrs. Warner attended the installation.

The industrial education department was started at Nebraska State Teachers College in 1908 by E. J. Huntemer. He retired in 1938, and R. A. Schreiner, a graduate of Peru State Teachers College and of the Colorado College of Education, is the head of the department now. R. D. Sellhorn, a graduate of Peru State Teachers College and of the University of Minnesota, is another member of the department staff.

♦ The New York Chapter of The American Designers' Institute held a meeting of the Architectural League on June 21, 1946.

This meeting was in conjunction with the Second Conference of Schools of Design which was being held at The Metropolitan Museum of Art during that week and was very well attended by educators from all over the country.

The American Designers' Institute has, since its inception in 1938, been intensely interested in the training of students in the field of industrial design and has had a committee on education working on a curriculum. This committee consisted of the following people: Alexander Kostellow, chairman; George Kosmak, secretary; Richard Bach, Joseph Aronson, Robert Thomson, George Cushing, Ben Nash, Ann Franke, Gerald Johnson, Eugene Korda, Michael Hallward, Arthur Nelson, L. Maholy-Nagy, Harper Richards, and Stewart Pike.

This educational program for industrial design is now available, and may be obtained by writing to the Committee on Education of the American Designers' Institute, 115 East 40th St., New York 17, N. Y.

♦ The National Society for Crippled Children and Adults, Inc., 11 So. LaSalle St., Chicago 3, Ill., will hold its annual convention at the LaSalle Hotel, Chicago, on November 3, 4, and 5, 1947. The program for Monday will be developed on the convention theme "The Handicapped — a Great National Resource"; for Tuesday on Rehabilitation; and for Wednesday on cerebral palsy.

♦ The National Association of Manufacturers, 14 W. 49th St., New York 20, N. Y., has issued a reading list of booklets on economic and social problems and a guide to motion pictures. This list can be very helpful to teachers who are interested in giving their students a real picture of economic and social problems that confront them and us in this world of today.

NEW PUBLICATIONS

(Continued from page 24A)

on plastics. In it are described both hand tool and machine tool operations, and how to use the various kinds of plastics for making numerous types of useful and ornamental things for the home.

The Fold-Ups — Art Metal Work Made With a Stick of Wood

By Louis J. Haas. Paper, 21 pp., 7 by 9⅞ in., illus., $1.50. Published by Louis J. Haas, 3 Gedney Terrace, White Plains, N. Y.

This is an enlarged and revised second edition of this book of an original technique of art metal work specially designed to require so few tools that a shop is not required.

Since one of the objectives in preparing this book was to produce designs and projects that could be used in occupational therapy work with the blind, the author developed the projects contained in the book while working blindfolded. The beauty of the designs, however, will also appeal to others who are interested in hobbies and crafts.

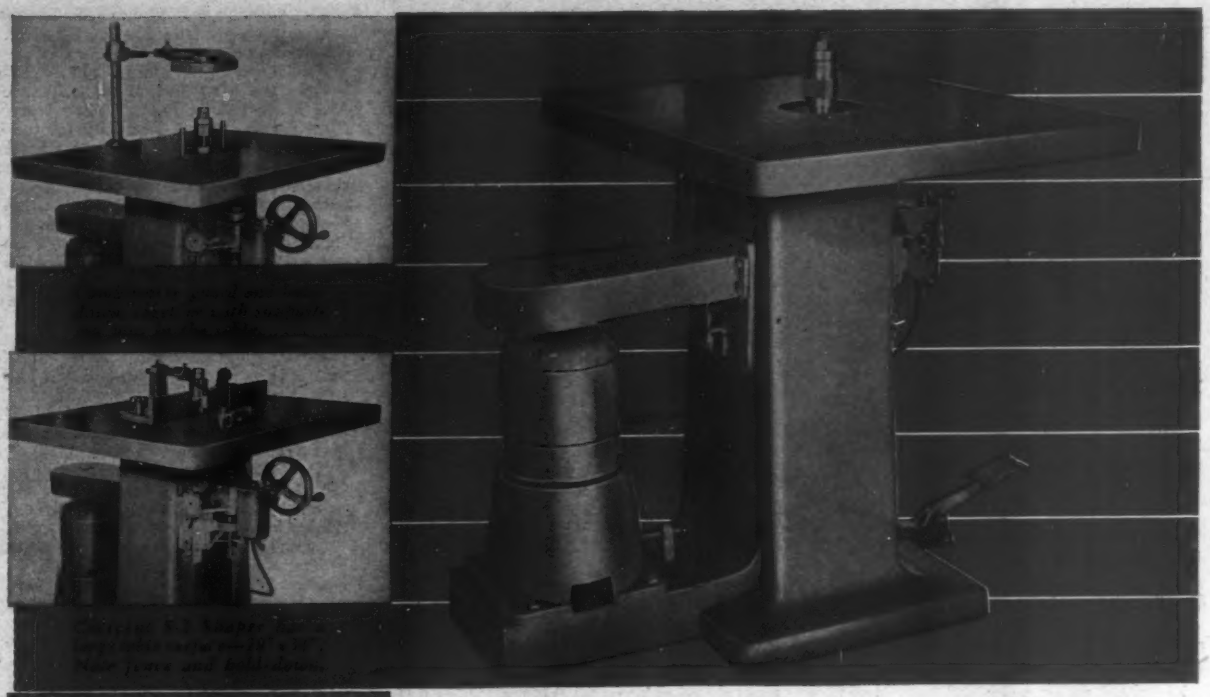
General Shop Metalwork

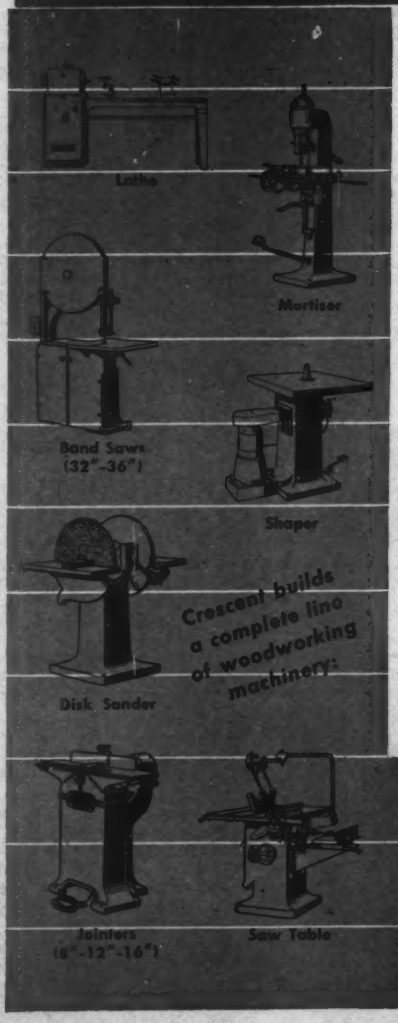
By A. W. Dragoo and Howard O. Reed. Paper, 102 pp., 7¾ by 10¼ in., illus., $1. McKnight & McKnight, Bloomington, Ill.

This is the third edition of this useful text. It covers the main divisions of metalworking — sheet metal, cold bent steel, bench metal, casting, welding, and art metal work.

Each section is accompanied by appropriate related information, by designs for suitable

(Continued on page 28A)





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One-piece, cored-out frame... for accurate, vibrationless performance

Your students turn out a smooth finished job — and confirm your good judgment in specifying Crescent S-2 Shapers for your shop.

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(Continued from page 26A)

projects, by step-by-step procedure outlines, and by directions for finishing.

Course Making in Industrial Education

By John E. Friese. Cloth, 29 pp., 6⅛ by 9⅛ in., illus., $3.50. The Manual Arts Press, Peoria, Ill.

This book is the outcome of considerable experimentation. It appeared first in mimeographed form, was used experimentally under many and varied conditions of teaching, was revised and rewritten and now appears as a book presenting the material in such a manner that it may be used in the training of both industrial arts and vocational education teachers.

The subject matter is divided into sections, as follows: the problem; steps in course construction; scope and format of courses of study; philosophy of industrial arts and vocational education; establishing aims of industrial education; aims of industrial departments and courses; analysis; related content; teaching methods; class organization and shop management; correlation; standards, tests, and grading; and curriculums in industrial education.

Several abstracts have been appended to show how the author's methods are worked out in practice.

Technical Drawing Problems

By Frederick E. Giesecke, Alva Mitchell, and Henry Cecil Spencer. Paper cover, spiral, 105 plates, 9⅜ by 11⅛ in., $2.75. The Macmillan Co., New York, N. Y.

This workbook presents 105 sheets of drawing problems which can be used in conjunction with any reference text on technical or engineering drawing.

The pages of the workbook are made of good drawing paper so that the student can make his pencil drawings directly on them. The size of the drawings when removed is 8⅜ by 11 in.

Industrial-Arts Electricity

By Clifford K. Lush and Glenn E. Engle. Cloth, 144 pp., 6¼ by 9½ in., illus., $2.20. The Manual Arts Press, Peoria, Ill.

An introduction to electricity for the beginner. It shows how magnetism and electricity is related, the two types of electricity and whence they come, how magnetism is produced by an electrical current, explains electrical currents, how heat and light is electrically produced, and discusses how electricity is transmitted for various purposes.

The book contains quite a number of wiring and construction jobs for the student. There also is a 100-item final examination.

Use of Native Craft Material

By Margaret Eberhardt Shanklin. Cloth, 135 pp., 5⅝ by 8½ in., illus., $2.75. The Manual Arts Press, Peoria, Ill.

An interesting book for the hobbyist. The craft materials discussed in the book are straw, corn, grass, rush, and clay.

Not only does the author show how to obtain the various materials, but also how to use them in making fine, well-designed articles.

Finishes for Aluminum (Section Two)

Loose-leaf, leatherette binding, 128 pp., 6 by 8¾ in. Edited and produced by G. W. Birdsall, manager, Technical Editorial Service, Reynolds Metals Co., 2500 So. Third St., Louisville 1, Ky.

Section Two of standard processes for pretreating, cleaning (chemically and electrolytically), electroplating, and lacquering objects made of aluminum.

Each section presents a statement of the purpose for which the process is intended, a number of references, the materials and the tanks needed for the job, and the electrical and other equipment required for carrying out the work.

Education Motion Pictures

Paper cover, 155 pp., 6 by 9 in., 35 cents in Wisconsin; 50 cents elsewhere. The University of Wisconsin Extension Division, 1204 West Johnson St., Madison 6, Wis.

This is a catalog of 16mm. silent and sound educational motion picture films.

Terms of service, directions to users, how to prevent damage to films, together with charts on suggested film use, and alphabetic and subject indexes to silent and sound educational films, are the divisions presented in the book.

A Treatise on Milling and Milling Machines — Section Two

Paper, 326 pp., 6 by 9 in., illus., $1. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

This is the third edition of this book designed especially for those who do precision work on milling machines.

The subjects discussed in this part of the work are: The Milling Process; Chip Formation, Surface Finish and Cutting Fluids; Power Required in Milling; and Mounting of Milling Cutters.

Course in Carpentry — Foundations and Framing

Prepared by California State Department of Education, Sacramento, Calif. Workbook section, paper cover, 148 pp., 8½ by 11 in., illus. Test section, 166 pp., 8½ by 11 in.

A workbook for first-year carpentry apprentices. It covers the units of trade mathematics and blueprint reading, foundations and form construction, and framing.

Women Can Be Engineers

By Alice C. Goff. Cloth, 227 pp., 5¾ by 8¾ in. $2.50. Published by Alice C. Goff, Youngstown, Ohio.

Written by a woman who is a structural engineer engaged in designing reinforced concrete buildings, this book portrays well how women engineers can succeed in satisfying their ambitions and at the same time offer a professional service that compares well with that rendered by the men in engineering undertakings.

The book portrays what 19 women engineers have accomplished in various lines of work, in spite of the handicaps that usually confront women in the engineering profession.

News Notes

♦ Teachers interested in the school savings bulletin should write for "Budgeting for Security," a study unit for Grades 6–12, published by the Education Section of the U. S. Savings Bonds Division Treasury Department, Washington 25, D. C.

♦ The Federal Security Agency, U. S. Office of Education, Occupational Information and Guidance Service, Washington, D. C., has just made available a "Guidance Bibliography" which lists the books for the Counselor's Professional Library selected by its specialists during the past months.

♦ Air-Age Education Research, 80 East 42nd St., New York City 17, N. Y., has established a "Classrooms in the Air" program, a special air travel service for schools and colleges.

For teachers planning educational air tours, the following eight-point service is offered: (1) help in organizing units of work for classroom preparation; (2) securing necessary classroom teaching aids; (3) planning flights to meet the particular needs of each group; (4) visiting classes to assist in the preliminary work; (5) suggesting methods of financing; (6) touring an airport before a trip; (7) providing a special instructor to accompany the group on the flight; (8) aiding in postflight discussions and evaluations.

Librarians, prospective librarians, vocational counselors, teachers, veterans, and others will find much useful information about careers with books in a new six-page leaflet, *Librarian*, by Alma A. Klaw, just published by Occupational Index, Inc., New York University, New York 3, N. Y. This abstract is now available from the publisher, 25 cents, cash with order.

Pertinent data is given on nature of the work, future prospects, qualifications, unionization, discrimination, educational preparation, methods of entrance and advancement, earnings, number and distribution of workers and advantages and disadvantages. The abstract also contains a recommended bibliography and an appraisal of available literature.

♦ A survey course on book, magazine, and advertising production will be offered this fall by the division of general education, New York University, in co-operation with the American Institute of Graphic Arts.

The course will consist of 15 weekly meetings, Tuesday evenings from 6 to 7:45, beginning on September 30 at the Concert Hall of the Barbizon-Plaza Hotel, 58th St. and Sixth Ave., New York City.

Topics to be covered will include: composition, platemaking, photoengraving, paper, printing by letter press and offset, the intaglio process, other methods of printing, binding, the background of art directing, the function of the art director, and office management.

Inquiries should be addressed to Paul A. McGhee, dean, division of general education, New York University, Washington Square, New York 3, N. Y.

♦ Michael Conner, 19-year-old graduating senior of Loyola High School—a branch of the Baltimore, Md., schools—recently was named grand prize winner of the $3,500 National High School Photographic Awards.

Four other first prizes of $100 each were awarded in additional classes as the judges selected a total of 361 prize winners. The class first prize winners were: William R. Bishop, New York, N. Y.; John Allen Astin, Bethesda, Md.; Donald Bowman, Hollister, Calif.; and Roland Rippel, New York, N. Y.

Second prizes of $50 each were awarded to Robert Grenier, Holyoke, Mass.; Frederick Sincock, Detroit, Mich.; Tom Hanlon, Des Moines, Iowa; Lee Huntling, Inglewood, Calif.; and Arthur Bilek, Chicago, Ill.

(Continued on page 31A)

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Here is the practical drilling machine for vocational training. As a widely used industrial machine tool, the Sibley offers the vocational student a basic preparation in industrial drilling operations.

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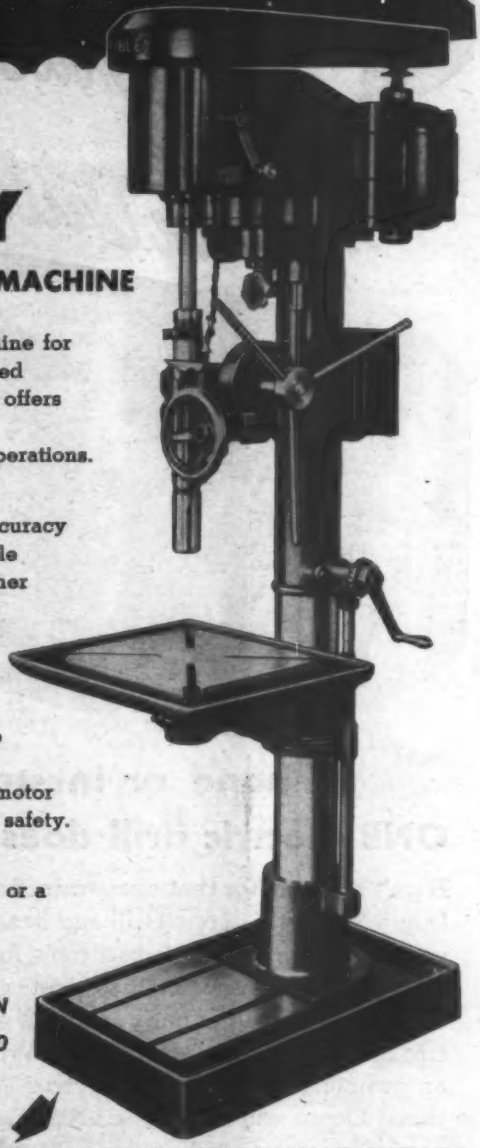
The model C-20 Sibley is modest in cost—permits installation of one or a battery at a low investment!



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(Continued from page 29A)

The 1947 National High School Photographic Awards, an annual contest open only to students attending daily high school grades from ninth to the twelfth inclusive in a public, parochial, or private school, began February 15. Entries closed May 15.

For information on future contest write to National High School Photographic Awards, 343 State St., Rochester 4, N. Y.

♦ The trustees of The James F. Lincoln Arc Welding Foundation announced today the rules of their annual engineering undergraduate award and scholarship program.

To familiarize undergraduate engineering students with the great contributions of arc welding to the prosecution and winning of the late war and the many ingenious and economic applications of this process to peacetime construction, The James F. Lincoln Arc Welding Foundation sponsors a series of $6,750 annual engineering undergraduate award and scholarship programs.

The program contains two interdependent plans: the award plan and the scholarship plan.

The rules of the program were reviewed and approved by the deans of engineering of 14 prominent engineering colleges. Papers must be postmarked not later than midnight, May 15, 1948, and awards will be announced as soon thereafter as is practical.

Copy of the rules and conditions may be obtained by writing The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

♦ The U. S. Savings Bonds Division, Treasury Department, has made a new classroom certificate available to teachers engaged in the school savings program. The certificate may be obtained free from the State Savings Bonds office.

♦ Additional occupational briefs now available from Science Research Associates, 228 S. Wabash Ave., Chicago 4, Ill., are: No. 201, Foreign Correspondents; No. 202, Aeronautical Engineers; No. 203, Stewardesses; No. 204, Beekeepers; and No. 205, Form Equipment Industry Workers. These briefs are priced at 15 cents each.

Science Research Associates also publish a Guidance Index — an annotated bibliography of selected guidance materials which appears monthly during the school year at $4 per year.

♦ The Evening and Extension Division, City College School of Business, 17 Lexington Ave., New York City, is offering an intensive 8-week course in "Food Store Management."

The course teaches the food merchant or the one who wants to get into business how to use his capital wisely and efficiently, how to plan and budget his operations for profitable business promotion, selling, buying, and merchandising. The course meets for two hours each week.

♦ A time-study laboratory, fitted with modern equipment and appliances, motion picture apparatus, and other facilities to demonstrate the techniques of work simplification in the industrial plant as well as in offices, has been set up in the School of Commerce, Accounts and Finance of New York University.

Closely resembling the average machine shop, the laboratory is equipped with drill presses, lathes, workbenches, and many other fixtures. It is located on the eleventh floor of the Commerce building.

♦ The Hobart Trade School has recently added an oxyacetylene flame cutting machine, an oxyacetylene flame cutting pipe cutter, a metal saw, a boiler plate roller, and some heat-treating apparatus.

Hobart Trade School graduates are meeting more and more tool and die steels upon graduation. It was decided, therefore, to give them complete training, not only in welding tool and die steels, but also in methods of heat-reating them.

♦ The News Bureau of the American Bankers Association, 12 E. 36th St., New York 16, N. Y., has issued a new comic book in colors, entitled "Peter Penny and His Magic Dollar," to inform children about the services of their home-town bank and the need for developing thrift.

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LATHES AND SHAPERS
Logan Lathe prices start at $159.50
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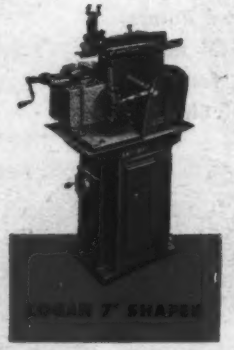
V and flat ways of the heavy-ribbed Logan Lathe bed are held to within .0005" of parallelism. The front bearing seat on the Logan Lathe ball bearing mounted spindle can vary no more than .0002". Total spindle runout 12 inches from the bearing is less than .0008". To hold to tolerances like these, one of every seven men building Logan Lathes is an inspector, skilled in the use of the most modern precision instruments. Operations, individual parts, sub-assemblies and completed machines are checked. That is why the Logan Lathe has earned a reputation for sustained accuracy and dependable, low-cost service in all fields of industry. Full information on the complete line of Logan Lathes and Shapers at your Logan dealer's, or on written request.



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♦ The I.P.I. essay contest, sponsored by International Printing Ink in co-operation with the National Graphic Arts Education Association, has announced the following as winners:

Winner of first prize of $500 in cash is David C. Dry, 18-year-old senior at Timken Vocational High School, Canton, Ohio.

A young Canadian, Norman Joly, of the Ottawa Technical High School, Ottawa, Ontario, is a double winner. His essay won second prize of $175 in cash for content, and a $20 cash award for excellence in printing the essay.

Third prize of $50 in cash goes to Eva Kallin, 14-year-old student of Aptos Junior High School, San Francisco, Calif.

The 1947–48 I.P.I. Essay Contest gives the entrants until October 31 to submit their entry cards.

The subject chosen for this contest is "Printing and a Free Economy."

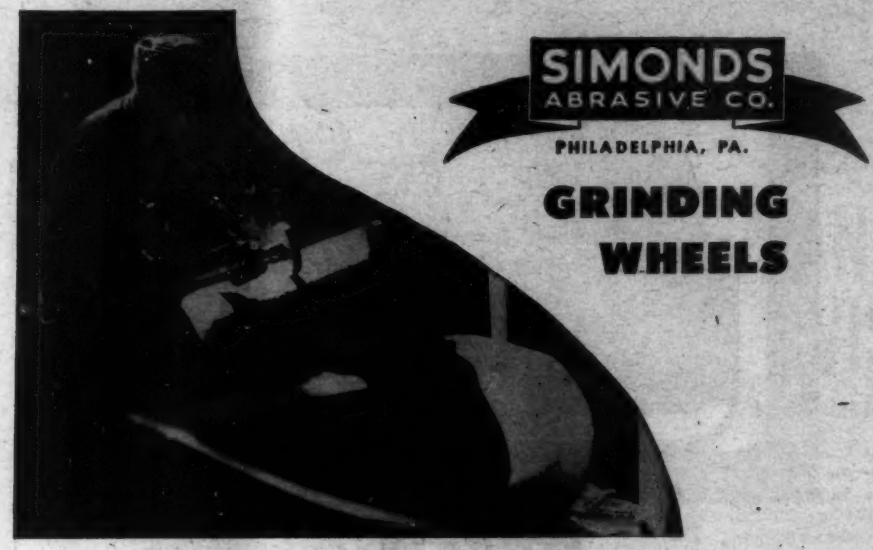
For further information write to Fred J. Hartman, educational director, National Graphic Arts Education Association, 412 National Savings and Trust Building, 719 Fifteenth St., N.W., Washington 5, D. C.

♦ Recognizing the growing importance of the industrial designer in the postwar American scheme of things, the California Institute of Technology, Pasadena, Calif., is offering a professional course in industrial design on the graduate level.

The need for such a course comes from Philip McConnell, executive secretary of the Society of Industrial Designers in New York. In a recent bulletin summarizing the answers to a questionnaire sent to leading industrial designers, he said "The mere fact that in 22 firms who answered there were positions open for 66 trained designers is an indication that sufficient training is not available."

The practicality of the Cal Tech course is insured by the inclusion on the faculty of men

(Continued on next page)



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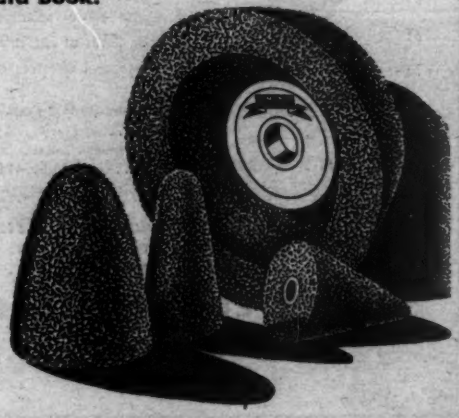

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(Continued from previous page)

who have won recognition as practical designers.

♦ Modern letterhead design is presented in an illustrated folder, "The Proper Use of Illustrative Treatment in Letterhead Design," published by the Lithographers National Association, 420 Lexington Ave., New York 17, N. Y. This educational folder makes the point that a good letterhead reflects the product or service of the company whose message it carries.

A copy of this folder is available for those who request it.

♦ "Priceless Cargo," a two-reel sound motion picture produced for the Superior Coach Corporation by The Jam Handy Organization, has been named the best nontheatrical motion picture on traffic safety produced during 1946. The announcement is made by the National Committee on Films for Safety.

The film dramatizes the importance of increased public education for safe transportation of school children.

♦ A new six-page leaflet entitled *Psychiatry*, by Florence L. Rome, has just been issued by Occupational Index, Inc., New York University, New York 3, N. Y. A thorough survey of the field, this pamphlet is now available for 25 cents, cash with order.

♦ The industrial division of the School of Engineering, Industries, and Trades at Utah State Agricultural College, is offering four-year technical courses in the fields of aeronautics, automotive and diesel, radio and electronics, machine work and tool design, woodwork and building construction.

One and two-year terminal vocational courses also are offered in such fields as welding, aircraft and engine mechanics, automotive repair, carpentry, machine-shop practice, radio service and repair, photography and printing.

♦ Occupational Abstracts reach the century mark with *Medical Secretary*, by Margaret T. Llano, Abstract Number 100. This six-page pamphlet is now available from the publisher, Occupational Index, Inc., New York University, New York 3, N. Y., for 25 cents, cash with order.

♦ A revised edition of the Occupational Abstract entitled *Office Machine Operator*, by Florence L. Rome, is now available for 25 cents, cash with order, through its publisher, Occupational Index, Inc., New York University, New York 3, N. Y.

♦ Twice within thirty years, because we tried to live among the family of nations with inadequate defenses, we were ruthlessly attacked. Mankind has not yet come to that stage of civilization where survival of the fittest, elimination of the helpless, is not a ruling force.

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Electronics	Plumbing and steam fitting
Engineering	
Hospital technician	Radio
	Welding

Those who may enroll in the Naval Reserve are: (*a*) navy, coast guard, and marine corps veterans of World War II, of any age, who served honorably for more than six months; (*b*) veterans of any other U. S. military service between the ages of 17 to 39 inclusive; (*c*) nonveterans, in the age group, 17–18½ years, and 17 to 39 years, inclusive, since expiration of the Selective Service Act on March 31.

For further information write to Captain E. O. Rigsbee, Jr., director, Naval Reserve Program — Room 1227, Navy Department, Washington 25, D. C.

♦ The American Occupational Therapy Association will hold its national convention November 1 to 7, 1947, at Hotel Del Coronado, across the bay from San Diego in California. It is the 30th anniversary of the association.

♦ A poster captioned "Seeing Through Life" is available from the National Society for the prevention of Blindness at 1790 Broadway, New York 19, N. Y. Recently revised and reprinted in bright colors, the poster emphasizes the measures that conserve and protect eyesight from the prenatal stage through old age. It is suitable for use in connection with health and safety education programs. Size, 19 by 25 in.; price, 30 cents per single copy, with reductions on quantity orders. If possible, remittance should accompany order.

♦ Clark Elkins, a member of the educational staff of The Jam Handy Organization, spoke to the Chrysler Co-operative School recently on the use of the slide film.

The Co-op School is attended by shop and industrial training teachers who divide their time between classes at Wayne University and work experience at Chrysler Corporation. The group was particularly interested in Mr. Elkins' demonstration of The Jam Handy Organization's discussional slide-film on engine lathe.

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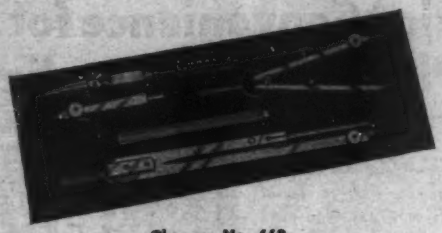

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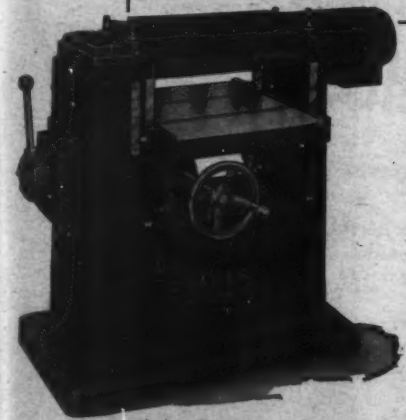

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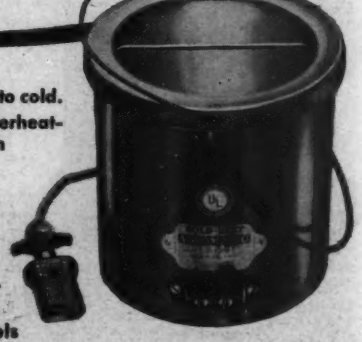

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Shop Equipment News

NEW PRODUCTS — PUBLICATIONS

NEW 16-IN. LEBLOND TOOLROOM LATHE

A wide range of spindle speeds, and increased ease of operation, are the outstanding features of the new 16-in. LeBlond Model RT toolroom lathe. Over 300 speeds ranging from 6 to 1500 r.p.m. are controlled by an ingenious speed adjuster unit.

Other engineering advances which add to ease of operation are: universal power rapid traverse which moves carriage, cross slide, and tailstock; the totaly enclosed universal quick change box is fitted with a revolving index plate on feed box which contains simple instructions for obtaining five different types of 60 threads and leads each; automatic lubrication throughout headstock, feed box, and apron requires little maintenance attention.

New 16-in. LeBlond model RT toolroom lathe

The new lathe also has a combination gear-belt drive headstock which provides spindle speeds in three ranges: the combined feed apron which has special arrangement for connecting length and cross feeds for cutting steep tapers in connection with geared type taper attachment; the thrust-lock tailstock with worm and rack construction which provides full length bearing support for spindle barrel; and an L-shaped bed which supports entire headstock base and which is fitted with replaceable flame hardened and ground steel bedways front and rear.

The lathe is powered by a 7½-h.p. adjustable speed main drive motor.

For complete description, send for bulletin RT-30. Address the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio.

For brief reference use IAVE—1101.

THE NEW B-3 NEWTON SANDER

The new B-3 Sander which has just been put on the market by the Newton Manufacturing Co., Temple, Tex., is adaptable to a wide variety of wood, metal, and plastic sanding operations. The sander incorporates many construction features fitting it to the needs of the woodworking shop, pattern shop, factories, schools, etc.

It may be operated with one 6-in. wide belt, or with two 3-in. belts (one fine and one coarse) for roughing and finishing operations on small pieces. In addition to vertical sanding in the position shown, the column and belt tilts back to any angle for angle sanding, with the table

The B-3 Newton Sander

remaining in its easy-to-use horizontal position.

Rotating it 90 deg., places the belt in a horizontal position and long pieces may be pushed over the top of it for edge sanding. In this position the worktable is removed and replaced with a parallel fence or crossbelt fence, depending on the nature of the work.

The sander is equipped with a single or three-phase, ¾ h.p. direct-drive motor. The sanding belt pulleys are rubber faced, ground true, and measure 3 and 4 in. in diameter. They can be used for spindle sanding operations on curved pieces with radii of 1 1/2 in. or larger, and since they are fed by the 54 1/2-in. length belt, cost of operation is much lower than when using sanding sleeves.

A miter gauge also can be supplied for the worktable for doing accurate sanding on compound angles.

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(Continued on page 38A)

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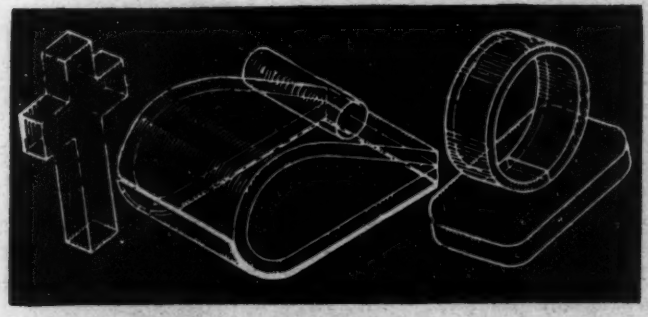

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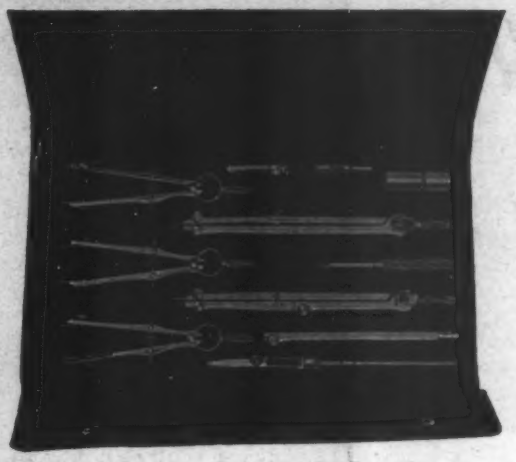

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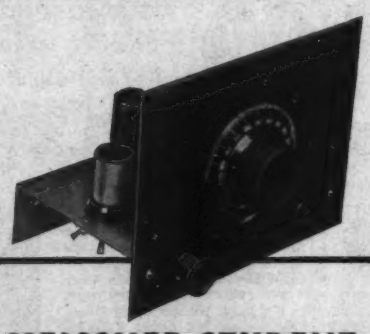

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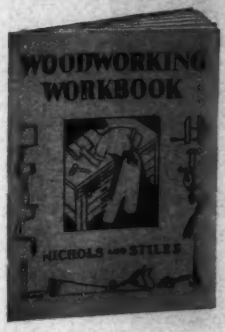

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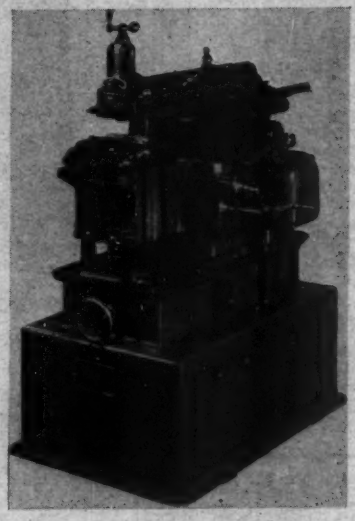
(Continued from page 35A)

the national organization of J. D. Wallace & Co., 140 S. California Ave., Chicago 12, Ill.
For brief reference use IAVE—1102.

NEW 12-IN. SHELDON SHAPER

Sheldon Machine Co. Inc., 4258 N. Knox Ave., Chicago 41, Ill., announce a new 12-in. precision shaper. Its streamlined pedestal fully encloses a variable speed motor drive which provides all



New Sheldon Vernon 12-in. back geared shaper

speeds from 12 to 180 strokes per minute at the turn of a handwheel. It has automatic cross-feeds in both directions of from .0025 to .0175 in. Its swivel table and swivel vise come as standard equipment. With all controls conveniently located within easy reach from operating position, this shaper is easy to operate.
For brief reference use IAVE—1103.

NEW PLASTIC-TIP HAMMER

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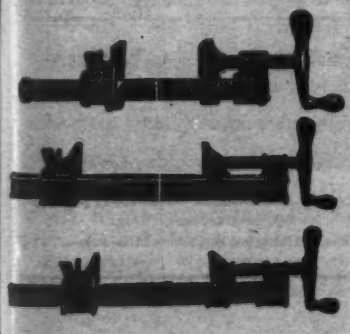

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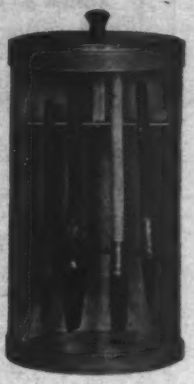

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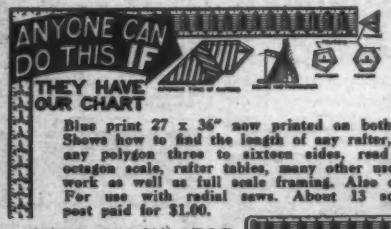

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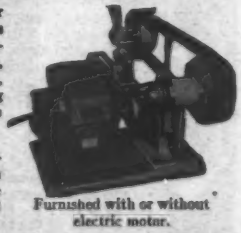

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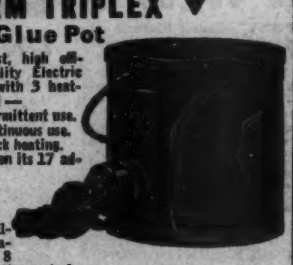

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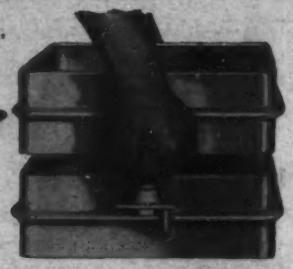

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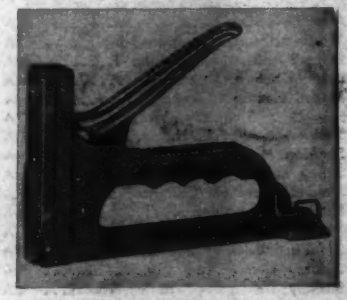

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